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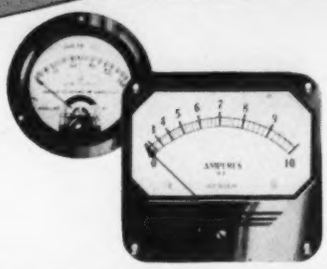
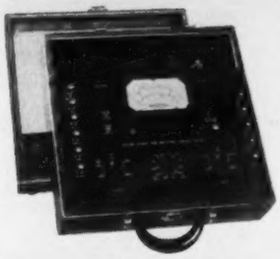
FOR ELECTRONICS MEASUREMENTS, TOO,

the Standards are Weston

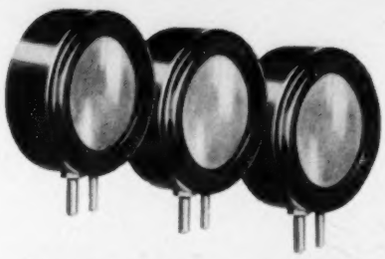


Panel Meters for Electronic applications



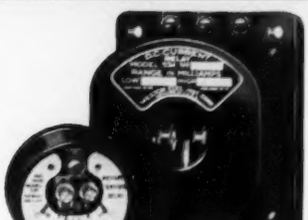
Electronic Circuit Testers

Ultra-Sensitive Laboratory Portables



*Photronic (photo-electric) Cells

Electronic Tube Checkers



Sensitive Relays

In the field of electronics, too, the measurement tools bear the name most familiar to you. For just as WESTON pioneered fundamental electrical measurement, as well as the special measurement needs of radio, so WESTON has provided simple, precise instruments and devices for the problems encountered in electronics research, production and control. Weston Electrical Instrument Corporation, 578 Frelinghuysen Avenue, Newark, New Jersey.

*PHOTRONIC — *A registered trademark designating the photoelectric cells and photoelectric devices manufactured exclusively by the Weston Electrical Instrument Corporation.*

Laboratory Standards . . . Precision DC and AC Portables . . . Instrument Transformers . . . Sensitive Relays . . . DC, AC, and Thermo Switchboard and Panel Instruments.

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Specialized Test Equipment . . . Light Measurement and Control Devices . . . Exposure Meters . . . Aircraft Instruments . . . Electric Tachometers . . . Dial Thermometers.

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Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

August 21, 1943 — Vol. 120, No. 8

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blished weekly. Price 25 cents a copy. Allow least ten days for change of address. Address communications about subscriptions to irector of Circulation, Electrical World, 330 est 42nd Street, New York, 18, N. Y.

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bscription rates: In the United States, exico, Central and South American countries, $5 a year, $8 for two years, $10 for ree years, Canada $5.50 for one year, $9 for o years, $11 for three years (Canadian oney at par). Great Britain and British possions, 54 shillings for one year, 108 shillgs for three years. All other countries $9 one year, $18 for three years. Entered second-class matter November 16, 1936, Post Office at Albany, N. Y., under the t of March 3, 1879. Printed in U. S. A.

ntents copyrighted, 1943, by McGraw-Hill blishing Company, Inc. Branch Offices: 520 rth Michigan Avenue, Chicago, 11, Ill.; Post St., San Francisco, 4; Aldwych House, dwych, London, W.C. 2; Washington, Philaphia, Cleveland, Detroit, St. Louis, Boston, s Angeles, Atlanta, Ga.

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Please change my address on Electrical World

From .....

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To .....

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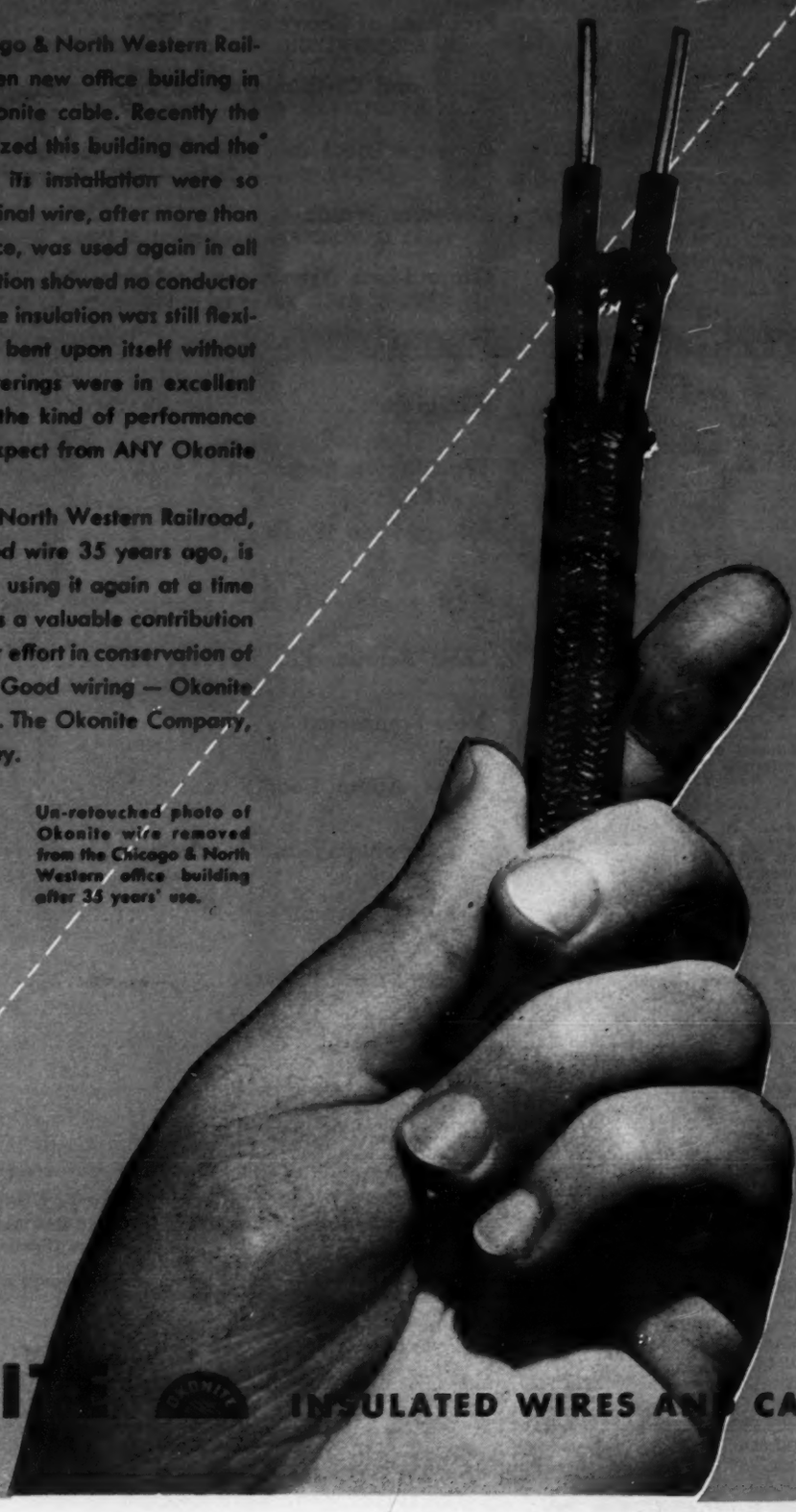
Signed .....

"this Wire doesn't owe us a thing!"

In 1907 the Chicago & North Western Railroad wired its then new office building in Chicago with Okonite cable. Recently the company modernized this building and the initial cable and its installation were so good that the original wire, after more than 35 years of service, was used again in all the circuits! Inspection showed no conductor corrosion. The wire insulation was still flexible and could be bent upon itself without cracking. The coverings were in excellent condition. This is the kind of performance record you can expect from ANY Okonite cable.

The Chicago & North Western Railroad, in selecting a good wire 35 years ago, is now benefiting by using it again at a time when it also makes a valuable contribution to our countrys war effort in conservation of critical materials. Good wiring — Okonite wiring — pays! . . . The Okonite Company, Passaic, New Jersey.

Un-retouched photo of Okonite wire removed from the Chicago & North Western office building after 35 years' use.



OKONITE INSULATED WIRES AND CABLES

3393

Electroline FIEGE

HEAVY-DUTY COUPLING

FOR SPLICING COPPER STRAND (300 to 1000 MCM)

Gives you these Big ADVANTAGES

1 **HIGH PRESSURE**—Metal to metal contact under high pressure gives ultimate electrical and mechanical strength.

2 **HIGH CONDUCTIVITY**—Its resistance is less than an equivalent length of the conductor itself.

3 **STRONGEST** TYPE OF COUPLING when used with steel, copper or composite strands.

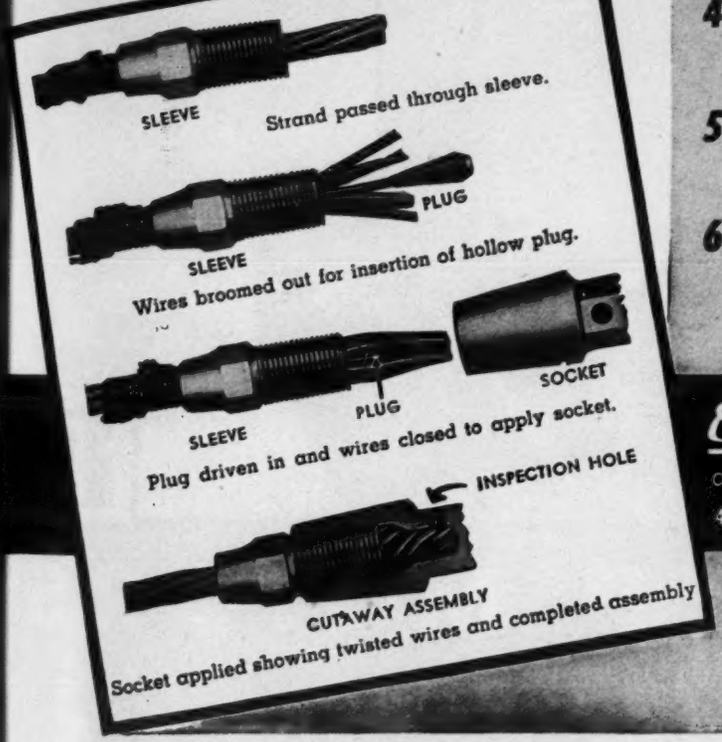
4 **NO WASTE** of conductor, in fact the coupling itself can be used over and over again. Easily disconnected . . . free from corrosion.

5 **SOLDERLESS**—No hot metal is needed. No special tools required. Common tools make or unmake the connection.

6 **EASY INSPECTION**—Inspection holes make visual inspection of the joint quick and positive. No guess work. A sound connection is certain.

SIMPLE TO INSTALL

ONLY THREE SIMPLE OPERATIONS ON EACH END—THEN THE COMPLETE JOINT



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Originators and Patentees of Automatic Line Splices and Dead Ends

4121 South La Salle Street Chicago, Illinois

Available in complete range of sizes from 300 MCM to 1000 MCM in straight couplings as illustrated. Also made in dead end types. *Write today for complete prices and illustrated literature.*

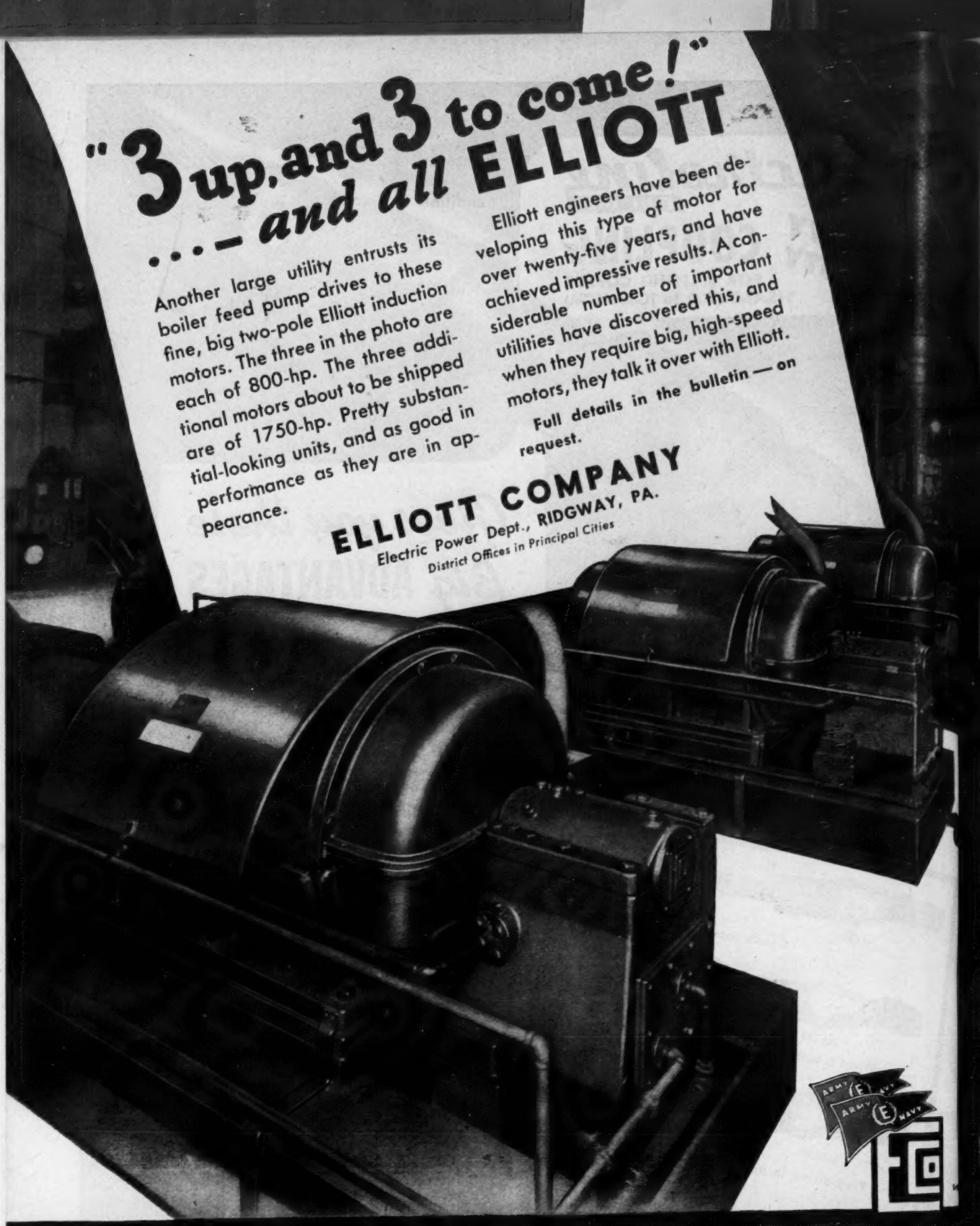
"3 up, and 3 to come!" ...—and all ELLIOTT

Another large utility entrusts its boiler feed pump drives to these fine, big two-pole Elliott induction motors. The three in the photo are each of 800-hp. The three additional motors about to be shipped are of 1750-hp. Pretty substantial-looking units, and as good in performance as they are in appearance.

Elliott engineers have been developing this type of motor for over twenty-five years, and have achieved impressive results. A considerable number of important utilities have discovered this, and when they require big, high-speed motors, they talk it over with Elliott.

Full details in the bulletin — on request.

ELLIOTT COMPANY
Electric Power Dept., RIDGWAY, PA.
District Offices in Principal Cities



ARMY (E) NAVY

ELLIOTT MOTORS

For important drive

CHECK the FACTS

IN THE R&IE ARCTIC LABORATORY—

1. July testing for January service.
2. Performance proven in advance.
3. Your weather conditions have been duplicated.
4. Complete switches tested with mechanism.

Shown here is a typical heavy coating of hard ice as produced in the R&IE Arctic Laboratory. Temperatures as low as 10° below 0 will solidly cover switch parts when outside temperature is 86° or higher.

R&IE ICE TESTS

The Check List

- CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS
- DISCONNECTING SWITCHES INDOOR AND OUTDOOR
- AIR BREAK SWITCHES
- INTERRUPTER SWITCHES
- CUTOUTS AND THERMO-RUPTERS
- SWITCH OPERATING MECHANISMS
- SUBSTATIONS
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- KIRK INTERLOCK SYSTEMS
- AUTOMATIC SECTIONALIZING EQUIPMENT
- METAL CUBICLES ✓

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

File....but

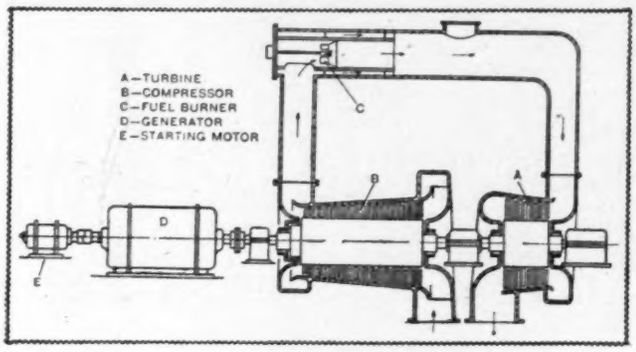
NEW IDEAS IN POWER AND ELECTRICAL EQUIPMENT ARE TAKIN

AVAILABLE UNDER HIGH PRIORITIES....ALL BELONG IN TH

☛ Power plant of the future probably will be built around gas turbines... operating at efficiencies equal to or better than diesels but with the low maintenance and simple lubrication of steam turbines. Building space per unit output will be lowest of any prime mover and no water will be required.

Present signs: already 19 Allis-Chalmers gas turbines and compressor units are employed in refining high-octane gasoline.

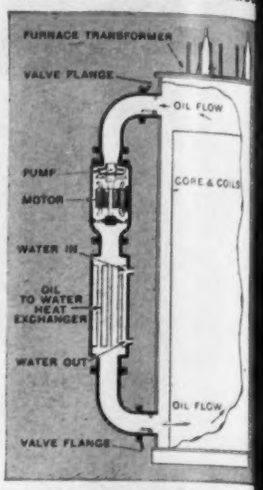
Operating sequence: 1) starting motor slowly rotates unit, building up air pressure, 2) fuel burner is ignited and hot gas enters turbine, 3) turbine takes load, drives compressor and generator, starting motor is disconnected.



OPERATING DIAGRAM OF MODERN COMBUSTION TURBINE

☛ Just moving oil faster in special transformer radiators — cools it enough so that designers need less copper and steel in transformer cores and coils. Allis-Chalmers "Electro-Cooler" does just that—but what's more it's done so simply that it makes forced oil cooling practical. That's the magic word—PRACTICAL!

So now that water-cooling coils are banned by WPB—and electric furnace transformers must be built without them—the "Electro-Cooler" with an oil-to-water heat exchanger replaces them. Allis-Chalmers transformer engineers save copper tubing—give steel makers a substitute for the water-cooled furnace transformer.



OIL-TO-WATER "ELECTRO-COOLER"

Investigate the widening applications of the "Electro-Cooler"—a unit composed of a heat exchanger and a "pump-in-a-pipe." Motor and pump are both immersed and lubricated by cooling oil.

☛ In the heart of a mercury arc rectifier, power-carrying electrons await the moment when a flash of bluish lightning will carry them from the anode to the cathode. There's one anode in each tank of a 6-tank Allis-Chalmers "Excitron" rectifier. Every 360th of a second, in sequence, bluish arcs flash in these tanks. What is the wizardry that times these arcs?

Excitrons are built to "fire when ready"—a procedure made possible by continuous excitation!

At the precise moment that a-c voltage on the anode equals the internal resistance of the mercury vapor gap—the bluish arc "train" leaves for the cathode.

AC WE WORK FOR VICTORY WE PLAN FOR PEACE

ALLI

don't forget

SHAPE FAST AT ALLIS-CHALMERS TODAY. SOME ARE ALREADY BACK OF EVERY LONG-RANGE PLANNER'S HEAD. HERE ARE A FEW:

Six pilot arcs burning steadily do the trick—they're always ready to start the "trains" on the 360th of the second. Herein lies the simplicity and stability of the Allis-Chalmers "Excitron."

High priority wall surrounds "Excitron" today, prevents all but most essential uses.

But plan to use it postwar. Higher efficiency of "Excitron" suggests profitable replacement of thousands of motor generator sets and synchronous converters.

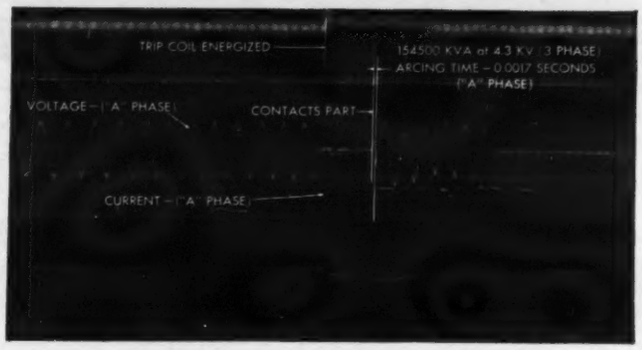
☛ Keep your eye on stronger trend toward air blast circuit breakers. Past year has seen Allis-Chalmers air-blast installations more than doubled.

Think of air-blast breakers in terms of protection and maintenance savings. Arcing times, less than 1/2 cycle throughout operating range, mean amazing contact life.

1,000,000 KVA AIR BLAST

Here's how it works in brief: small contact piston pulls back from orifice, high pressure dry air rushing into hole. Arc rushes through, too . . . stretches out and vanishes—at split-cycle speed.

Reliability? Air brake systems of heavy trains are no safer.



OSCILLOGRAM OF AIR BLAST INTERRUPTION

☛ Biggest graphite "pencils" in the world write the flaming story of armor in the electric arc furnaces of Uncle Sam. Formerly these pencil-like electrodes were misguided by erratic up and down movements—calculated to keep pace with the melting charge. But at 3000 deg. F—overtravel and under-travel just burned them up and caused inefficient melting.

With a new sensitive, wide-range control generator called the "Regulex" exciter — Allis-Chalmers engineers are keeping furnace arcs constant, enabling extra "heats" per day, conserving graphite electrodes. Steel men are happy now!

Basic fact is that amplifying characteristics of "Regulex" exciter parallel in many respects those of the electronic tube—with the important exception that it has d-c machine life and ruggedness.

Look for other important new developments in electrical and power equipment from Allis-Chalmers. Maybe we can help you — maybe you can help us. ALLIS-CHALMERS, MILWAUKEE, WIS. A1612

-CHALMERS

Compare—and You'll Pick Ampac!

It makes a big difference which a-c welder you pick today. See how much more new Allis-Chalmers Ampac "200" gives you in better, faster work!

Compare 4 leading types of Transformer Welder in their Use of 11 Important Features . . .

	IMPORTANT FEATURES	HOW THEY BENEFIT YOU	AMPAC "200" (Integrated moving core type)	WELDER "B" (Moving coil type)	WELDER "C" (Moving core type)	WELDER "D" (Shunt type, moving core)
1	No arc blow to slow down welding.	Steady arc makes sound, uniform welds. You can weld in corners and grooves easily. Production is speeded.	YES	YES	YES	YES
2	Low striking voltage at high amperage.	Saves power for you. No need for high voltage at high currents. Raises power factor — cuts power input.	YES (65 volts)	NO (75 volts)	NO (75 volts)	NO (75 volts)
3	High striking voltage at low amperage.	Strikes arc fast. Gives you high, yet safe voltage necessary. Makes a-c welding easy at low currents.	YES (78 volts)	NO (72 volts)	NO (75 volts)	NO (75 volts)
4	Takes less than 300 sq. in. floor space.	Small size saves valuable space on crowded shop floors . . . makes it easier for you to move and handle the unit.	YES (288 sq. in.)	NO (384 sq. in.)	NO (398 sq. in.)	YES (288 sq. in.)
5	Contains less than 5 wearing parts.	Cuts maintenance to simple lubrication twice a year. Less chance for wear means longer service, lower upkeep.	YES (4 parts)	NO (8 or more)	NO (9 or more)	NO (8 or more)
6	Low original cost (no rotating element).	Simpler construction of a-c welder cuts purchase price to around 65% of what you would pay for a d-c welder!	YES	YES	YES	YES
7	Wide welding range of over 200 amperes.	You can weld thin sheets . . . yet have capacity for heavy plates, too. You can use rods from 1/16" to 1/4" in size!	YES (220 amp)	YES (215 amp)	NO (195 amp)	NO (185 amp)
8	Reconnectable for 220-440 & 208 v., 60 cycle.	Gives you full capacity at low voltages where lines are long and isolated. Can be used on *any* standard a-c voltage!	YES	NO (220 or 440)	NO (220-440 only)	NO (220-440 only)
9	Over 85% efficiency at normal loads.	You enjoy *full* benefits of a-c welding: lower power loss, high power factor, lower operating costs!	YES	NO	YES	YES
10	All settings within six control turns.	Saves welding time. Welder can make simple adjustment from high to low amperage current quickly and easily.	YES (6 turns)	NO (30 turns)	NO (30 turns)	NO (15 turns)
11	Movement of variable part 2" or less.	Cuts wear and maintenance to a minimum. Reduces hum and vibration Contributes to trouble-free operation.	YES (1 inch)	NO (9 inches)	NO (6 inches)	YES (2 inches)
			11 Ampac "200"	3 Welder "B"	3 Welder "C"	5 Welder "D"

Only Ampac gives you all 11 . . . TOTALS

ALLIS-CHALMERS AMPAC "200"

WRITE ALLIS-CHALMERS, MILWAUKEE, WIS., FOR COMPLETE INFORMATION

A1619

LET "Assistant Cables" CARRY PART OF THE LOAD

If your insulated power cables are loaded to their limit and there is a demand for more service, you must do something about it. In times like these your decision what to do will be influenced by shortage of materials, military requirements, priorities, and manufacturing restrictions.

You may find that instead of replacing an old cable with a larger one, better results can be obtained by installing an "assistant cable" in parallel with that now in service. If that can be done you will not only keep your old cable in service but you may carry your full load with less copper than would be required for complete replacement of your present cable installation.

To get best results, any cables you buy should be designed by cable engineers to fit the job they are to do and at the same time to get maximum use of the critical materials that go into them. If you need cables for essential work let us tell you more about Simplex cables.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge 39, Mass.

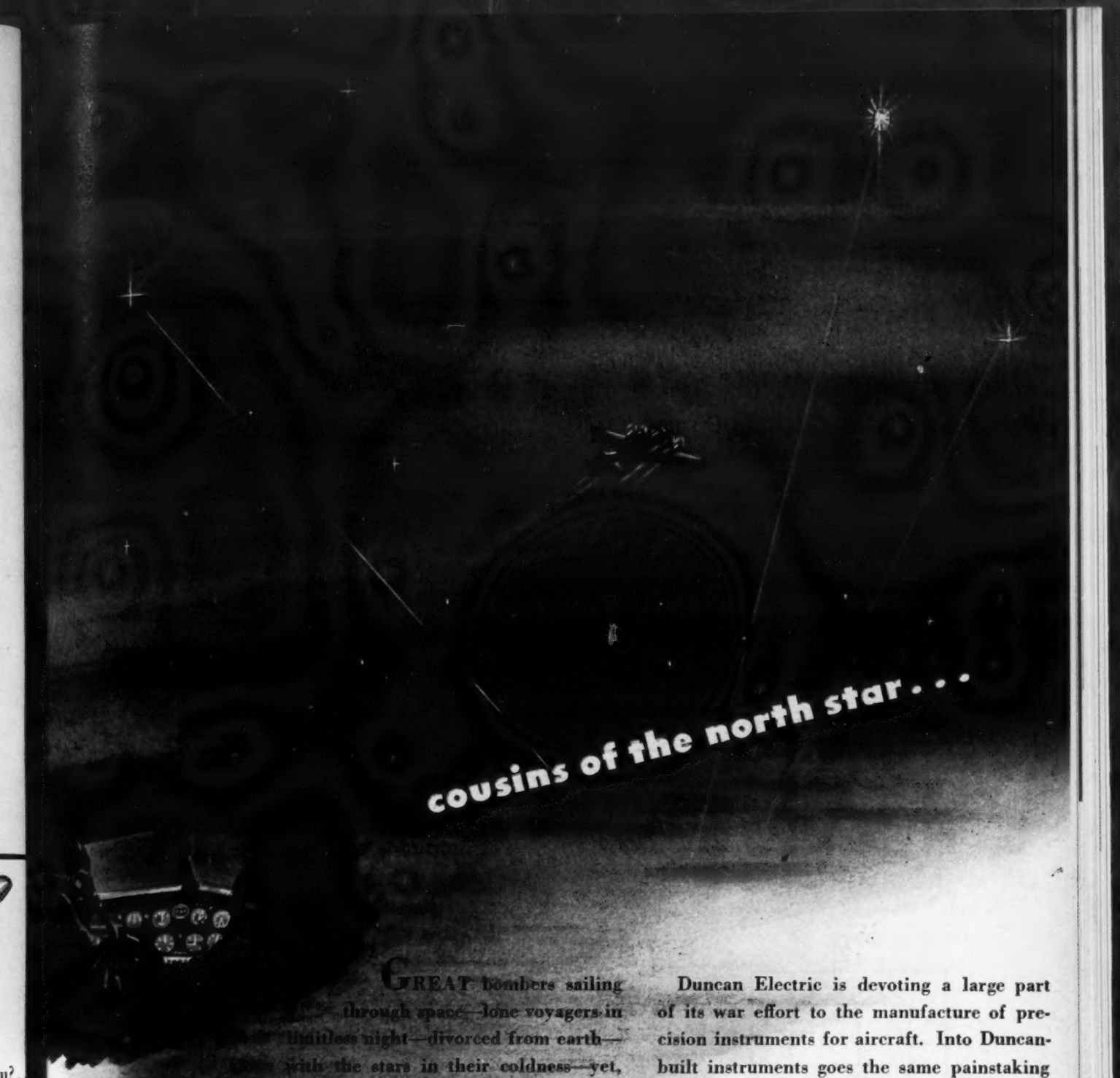
Simplex WIRES and CABLES

"And NOW — I am a MAN!"

Remember your first long pants? Felt pretty swell, didn't you?.. Well, you likely feel right good today, too, when you think abo your profitable heating load—still being well maintained, becau the devices are still plugged in . . . still in use, because of the durable Chromel elements. Again, we modestly remind you tha that load was largely made possible, by our discovery of Chrom more than 35 years ago. For you see, Chromel was the first heatin element alloy that was really durable. Chromel thus solved the vit heating element problem and thereby gave you your heating-loa Glad to send you Catalog-M.

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY, DETROIT (8), MICHIGA



GREAT bombers sailing through space—lone voyagers in limitless night—divorced from earth—alone with the stars in their coldness—yet, boring in upon the objective—a pin-point fixed in vastness—as though drawn to it by a mighty magnet. This is the miracle of modern navigation—wrought by delicate, precision instruments—true cousins of the North Star, ancient guide of the mariner.

Duncan Electric is devoting a large part of its war effort to the manufacture of precision instruments for aircraft. Into Duncan-built instruments goes the same painstaking care and skill that has characterized Duncan Watthour Meters throughout the years.

When victory is won, Duncan will return to the full time manufacture of watthour meters—will employ all of its skill to bring you the best that modern science can build.

DUNCAN ELECTRIC MFG. CO.

Lafayette **Indiana**

DUNCAN

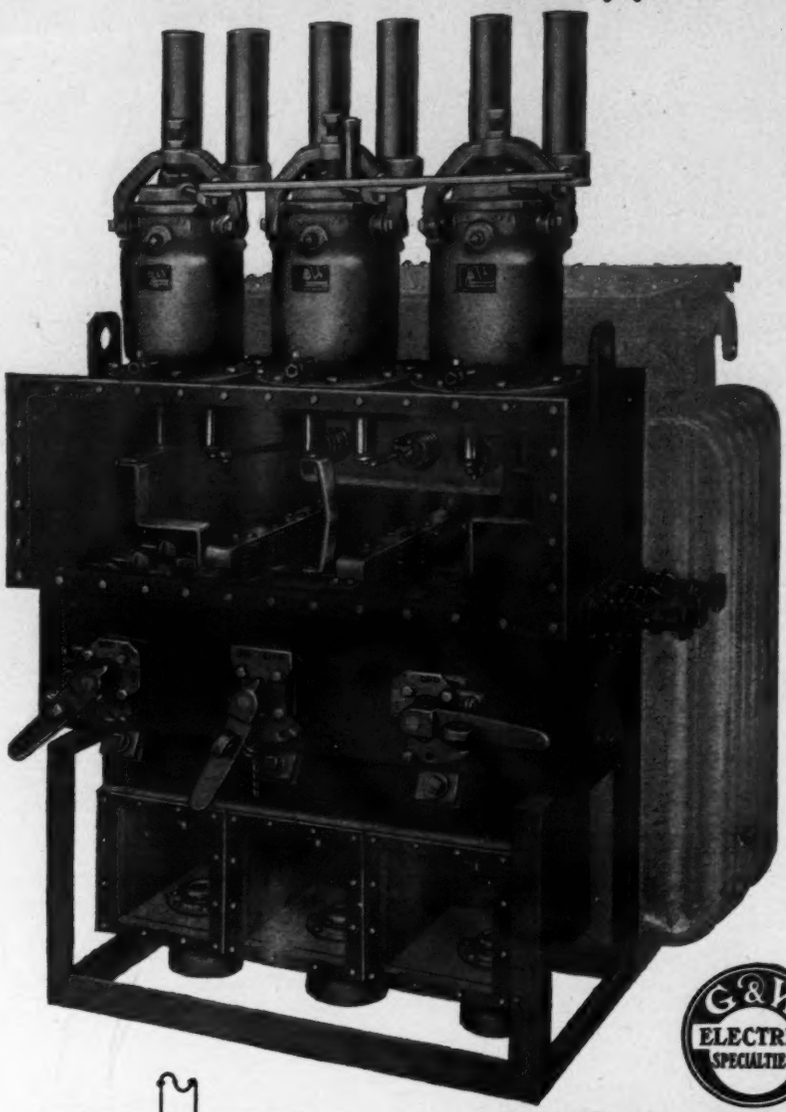
WATTHOUR METERS

...makers of precisi[illegible] watthour meters for [illegible] ty years

Combine G & W Type "RA" Oil Switche

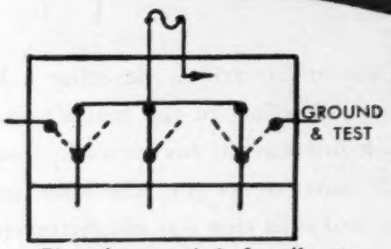
WITH
G & W TYPE "FC"
OIL FUSE CUTOUTS
and other equipment

— SAVE INSTALLATIO
LABOR — SAVE SPAC
— DECREASE INTERCO
NECTING CABLE WOR

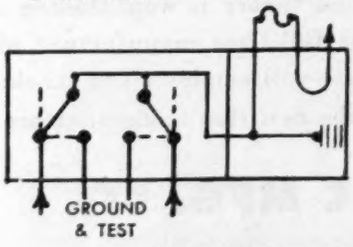


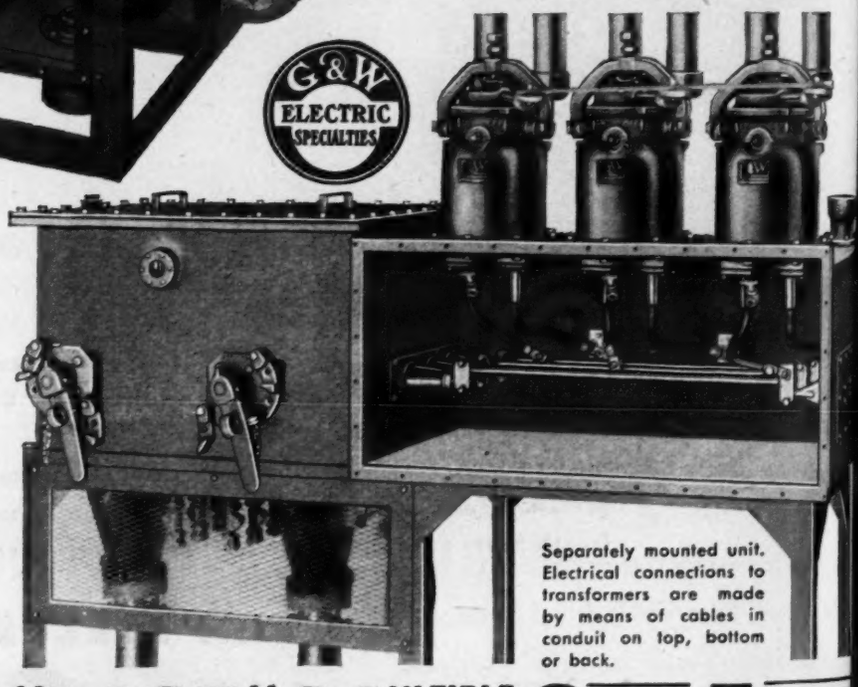
Here is real forethought . . . plannin
in advance for easier installation
equipment to fit into a smaller space. A
to provide for safe, economical o
trouble-free distribution system flexibi
. . . Simplify transformer substations
using G & W TYPE "MSF" combinat
metal enclosed units for switching a
fusing.

G&W ELECTRIC SPECIALTIES



The above unit is for direct attachment to transformer.



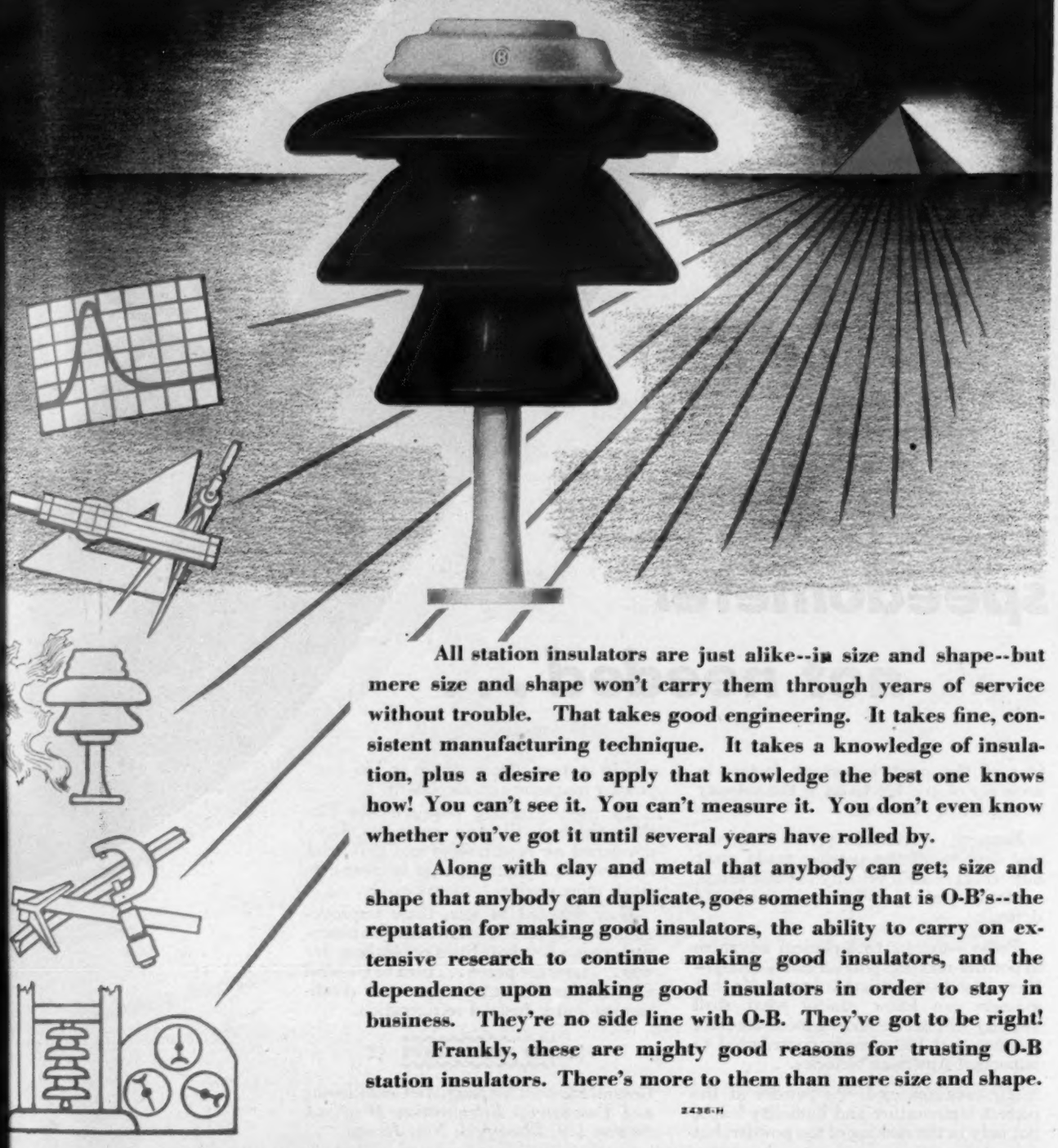


Separately mounted unit. Electrical connections to transformers are made by means of cables in conduit on top, bottom or back.

Specify **TYPE "MSF" MULTIPLE SWITCH FUSE UN**

G & W ELECTRIC SPECIALTY CO., 7780 DANTE AVENUE, CHICAGO, ILLINOIS, U. S. A.
IN CANADA POWERLITE DEVICES, LTD. TORONTO
POTHEADS . . . BOXES . . . OIL FUSE CUTOUTS . . . OIL SWITCHES AND MULTIPLE CIRCUIT OIL DISCONNEC

THERE'S MORE TO STATION INSULATORS THAN MERE SIZE AND SHAPE



All station insulators are just alike--in size and shape--but mere size and shape won't carry them through years of service without trouble. That takes good engineering. It takes fine, consistent manufacturing technique. It takes a knowledge of insulation, plus a desire to apply that knowledge the best one knows how! You can't see it. You can't measure it. You don't even know whether you've got it until several years have rolled by.

Along with clay and metal that anybody can get; size and shape that anybody can duplicate, goes something that is O-B's--the reputation for making good insulators, the ability to carry on extensive research to continue making good insulators, and the dependence upon making good insulators in order to stay in business. They're no side line with O-B. They've got to be right!

Frankly, these are mighty good reasons for trusting O-B station insulators. There's more to them than mere size and shape.

2436-H

EEP BUYING WAR BONDS

Ohio Brass MANSFIELD, OHIO

CANADIAN OHIO BRASS CO., LTD. NIAGARA FALLS, ONT.

speedometer not needed . . .

One of the most important factors in accuracy of gun-fire today is the velocity at which a shell travels.

Formerly, variations in the structure and dryness of the powder made great differences in shell velocity . . . and hence, made accurate gun-fire correspondingly difficult.

Today—thanks to technical advances in powder-making *plus air conditioning*—there is so little variation in powder that gunners can know *exactly* what shell velocity will be. Result—a more accurate gun-fire that has already contributed to important American victories.

Air conditioning keeps powder at the correct temperature and humidity levels, not only in the making of the powder, but also in storage places ashore and in powder magazines on shipboard.

To meet exacting requirements like this, General Electric engineers have developed *air conditioning* and *industrial refrigeration* equipment that is more efficient, more compact, more flexible.

Now devoted to war, these improvements will be turned to innumerable peacetime uses when hostilities cease. Now for war . . . later for peace . . . turn to General Electric for efficient, compact air conditioning and industrial refrigeration.

☆ BUY WAR BONDS ☆

General Electric Company, Air Conditioning and Commercial Refrigeration Divisions, Section 439, Bloomfield, New Jersey.

Air Conditioning by

GENERAL ELECTRIC

Listen to the General Electric radio programs: "THE HOUR OF CHARM", Sundays, 10 P.M., E W T, on N B C . . . "THE WORLD TODAY" News, Weekdays, 6:45 P.M., E W T, on C

No More Burned-down Conductors Resulting From Power Arcs

-when you apply O-B arcing horns

O-B Longhorn, applicable to circuits up to 161 kv. Conductor is shielded from the burning effect of power arcs without reducing structure clearances or producing radio signal interference.

● You can't afford to expose precious conductors to the damage of power arcs when it's so simple to prevent. O-B arcing horns shield these conductors without reducing present structure clearances, and they provide this protection at all voltages without producing radio interference.

O-B Longhorn is applicable to circuits up to 161 kv., and the Bighorn carries this protection up to the highest voltages. Below 69 kv., conventional strap horns only are sufficient, and they may be applied in some cases to the upper end of the insulator string at higher voltages, with O-B tubular horns adjacent to the conductor.

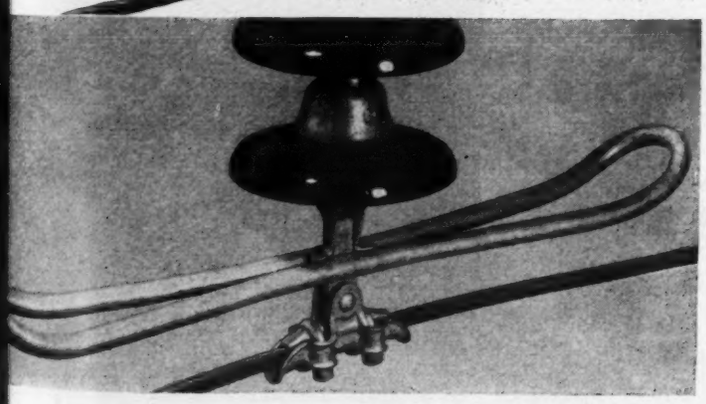
Now, when conductor is so difficult to get and continuous power so important to deliver, you may install effective protection against one of the big enemies of power cable life. Apply O-B arcing horns.

2425-H

Ohio Brass

MANSFIELD, OHIO

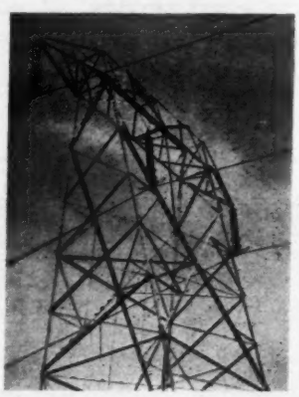
Canadian Ohio Brass Co., Ltd., Niagara Falls, Ont.



Left: O-B Bighorn for use beyond 161 kv. Similar to the other model, structure clearances are not sacrificed and no radio interference is produced, yet valuable conductor is completely protected from burning by arcing.

KEEP BUYING WAR BONDS

Right: A recent installation of O-B Bighorns.

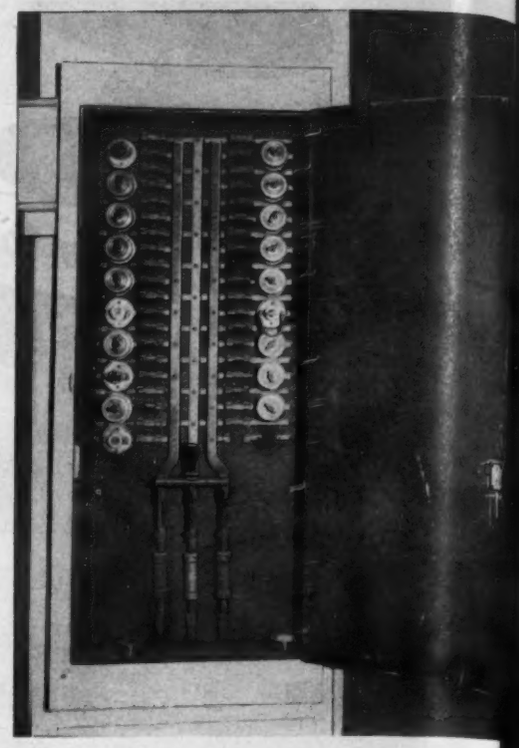


Plants with *obsolete equipment* can not compete with those *modernly equipped...*

✓ Check up

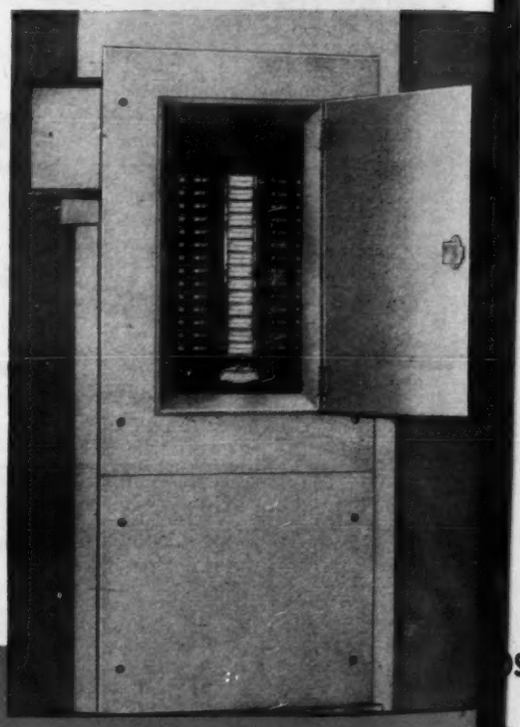
on your electrical distribution system—including

- ☐ Switchboards
- ☐ Panelboards
- ☐ Safety Switches
- ☐ Wiring



▲ This old Ⓕ Fuse-Type Panelboard had been u for many years. Still serviceable, it was obsolet upkeep out of reason, repair parts no longer obta able. Its *20 circuits* could not meet the demand. A the exposed bus bars and main knife-switch cam an element of danger.

Replaced with this efficient, safe and decorative Panelboard, *28 circuits* were installed in *one-fi less space*. Modern *automatic* protection was assu by the Ⓕ Dublbrak Circuit Breakers, which also ma restoration of service simple and easy. All current-carrying parts are covered.



If they are not the best for the job they must do — today or after the war — plan now to replace them. Higher production costs are the penalty for not modernizing.

Consultation — without Obligation

There is an Ⓕ Sales-Engineer near you who will be glad to consult with you or your engineer and to inspect and report on your electrical system. If it is efficient and in proper condition, he will say so. If not, he will suggest changes for betterment. After that — it's up to you.

If you are engaged in war production, and changes are desirable to reduce costs or increase output, Ⓕ can give you good service. If not — we'll have to wait until Victory perches on our banner.

In either event — *Plan Now!*

EST. 1891 THE SIGN OF A BETTER JOB

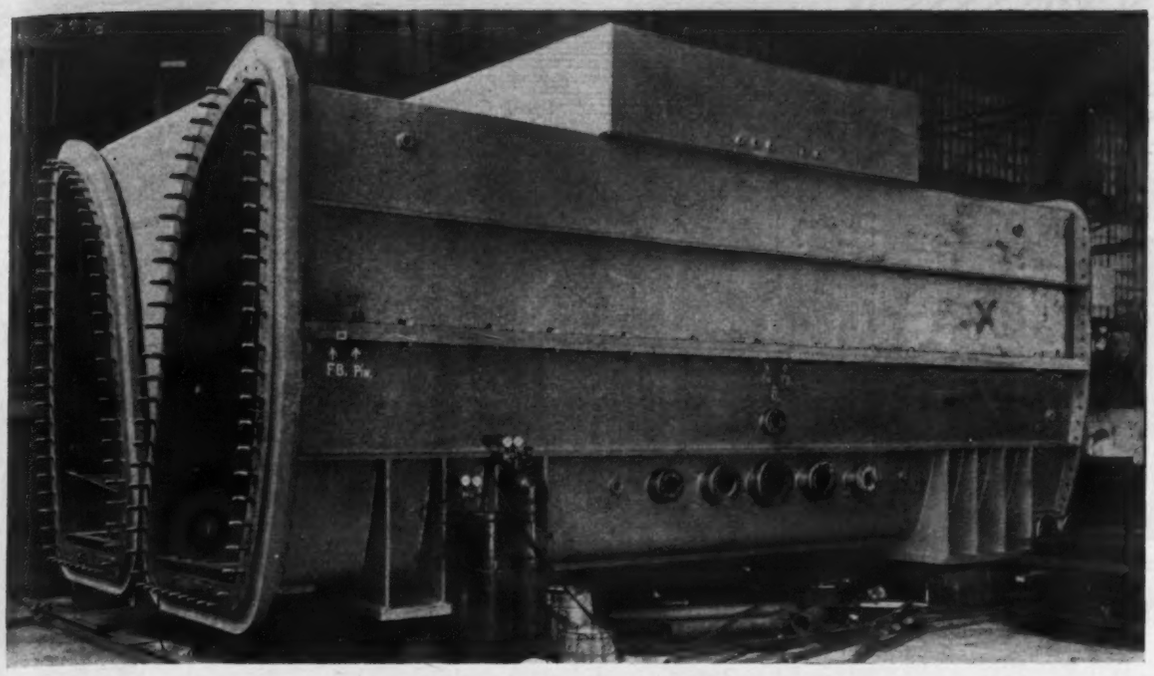
FA

Frank Adam

ELECTRICAL PRODUCTS
for War Industry

FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

For more than fifty years one of the country's leading producers of electrical equipment for industrial, commercial and residential use



Baffles divide tube bank into small sections and drain off condensate.

Low-Head Condenser—26,850 Sq. Ft.

During plant modernization, a large southern utility was recently faced with the difficult problem of installing a 26,850 sq. ft. condenser and hotwell in a restricted space having a headroom of only 12 feet. A thorough study of the engineering of available designs resulted in the selection of a Foster Wheeler low head, single-pass, cross flow condenser.

This design features a large central steam space which divides the tubes into two banks thus providing the necessary longitudinal distribution of steam without the usual large steam dome. Shallow tube banks permitting good steam penetration, plus the radial tube arrangement result in maintenance of constant steam velocities and equalized pressure drops throughout the tube banks. Baffles placed parallel to steam flow divide the condensing surface into three sections and drain off condensate which otherwise would fall through the tube sections with resultant increase in pressure drop and reduced heat transfer.

OSTER WHEELER CORPORATION **165 BROADWAY, NEW YORK, N. Y.**

FOSTER WHEELER

VOTE HERE
This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.

DEMOCRATS *need "Seed Money," too*

Seed Ideas and Seed Money

Whether you run a whole business, a plant or a section, the very fact that you hold this magazine in your hands indicates that you are interested in *improvement.*

Did you ever stop to think that that instinctive desire to find a better way of doing things is the fundamental driving force of America?

It is.

If allowed to function in an environment economically and politically favorable to industry, this American instinct for improvement can carry us forward to undreamed standards of living and of culture.

The only barrier to constant improvement is lack of public understanding.

Industry cannot have a favorable environment, however, until industry itself clearly defines its objectives, and explains them clearly to every citizen *in terms of social progress.*

This Seed Money advertisement (reprinted from the McGraw-Hill newspaper campaign now running in Washington, New York and Chicago) is intended as a starter in a nation-wide process of education on the source of good living.

Some companies are running the Seed Money Advertisements locally, over their own signatures. Others are starting their own campaigns. Either way, the Seed Idea is being planted.

If you would like to reproduce this message in your plant city, free mats and booklet reprints (sold at cost) are available.

James H. McGraw, Jr.
President

McGraw-Hill Publishing Company, Inc.

NOW don't get excited, folks, this isn't a political advertisement. We've got some thoughts on our mind about how to make big problems simple, and we are using the word "democrat" the way the men who thought it up used it.

More than 2,000 years ago, the Greeks decided to quit believing in Superman, and they invented this word to express their general idea.

► Every schoolboy knows how that idea was pulled off the shelf sometime back, and a form of government hammered out that would allow Joe Doakes enough personal elbow room to do his stuff in the world.

Every schoolboy knows, too, that what followed—particularly in America—was the most rapid development ever known.

Within the memory of living men, we have traded the economy of the hoe for the tractor, the muscle for the motor, the eye for the electronic tube.

So vast has our mechanical might become that by shifting the ends of our production lines from the garage, the kitchen and the living room to the skies above Italy, Germany and Japan, we are changing the history of the whole world.

With all this glory to his credit, wouldn't you think the common man would know how he did it,

FREE MATS: If you would like to publish this message over your own company name, or distribute it in handy booklet form, write or wire: Research Dept., McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York (18), N.Y.

EMOCRATS *need "Seed Money," too* (cont'd)

how to keep on the road to better living after war?

He doesn't know, because he discounts the t that his own, native love for *improvement* ys in our national life.

This love for *improvement* started on pioneer ms. It continued in millions of garages and kitch-. It rides with every American gunner today.

American *improvement* is essentially a Joe akes affair. Here's how it works:

1. Joe invents something and invests Seed Money in equipment and materials to make it.
2. People buy it.
3. That makes good paying jobs.
4. Joe invests more Seed Money to improve his product or his method of making it.
5. More people buy it.
6. That makes more good paying jobs.
7. Joe invests more Seed Money in more and better machines, to get volume production.
8. So, Joe lowers his price.
9. Still more people buy.
10. That makes more good paying jobs.

y to figure out any other foundation for Amer-n wealth, leisure, culture, fighting strength or terial possessions!

This simple progression, multiplied by mil-ns of instances, explains why "Seed Money" so important in our national life.

Seed Money is used every time a product or machine is improved, because Seed Money eans "that part of profit which is 'plowed back' o a business."

Joe Doakes will need his Seed Money, to tract customers and create jobs when this war over. But a dangerous percentage of Joe's Seed oney is being blotted up in the Excess Profits Tax.

Perhaps our government intends to return some of this money after the war, as a loan. But this would mean another government bureau, more Federal employees, all of which will further increase the cost of government. But above all—Business will not be free to "take a chance" with this money. It belongs to the government. Hence, the "take a chance" spirit, the life breath of progress, will be hobbled just when Americans need it most.

► There is a simple and much more effective way to supply our American industry and commerce with Seed Money.

Change our tax laws to permit industry and business to set aside from present earnings the tax-free Seed Money that they will need to reinvest in improvement of plant, products or essential operations to create jobs after the war.

To put this simple, effective procedure into practice, our government must change its attitude toward the source of all improvement—Seed Money. To bring this about, remind your Congressman that:

"Industrial Progress
is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

24 publications, which gather "war-news" from the "war-production-front" through a staff of more than 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

This advertisement is available in handy booklet form. (Less than 100 copies free. Larger quantities, $1.00 per 100; $10.00 per 1000.)

McGRAW-HILL

PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK (18), N. Y.

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

eries Machinist • Air Transport • Aviation • Aviation News • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering nstruction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • M. J. Metal and Mineral Markets • Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman

iness Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation

ONE UNIT · ONE ORDER · ONE SHIPMENT · ONE INSTALLATION

one

NEW LIGHT-DUTY CSP POWER TRANSFORMER REPLACES 43 SEPARATE PIECES OF EQUIPMENT

This complete factory-packaged substation is first choice for industrial service.

Its compactness and portability permit installation nearer the load center. This improves voltage regulation . . . and saves on copper runs.

The CSP Power Transformer performs all the functions of a conventional substation . . . it occupies less than one-third the space . . . and is better looking.

CSP (Completely Self-Protecting) means:

(1) Three-point protection against lightning.

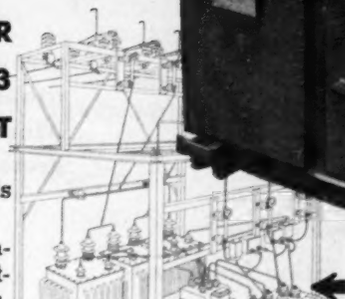
(2) Automatic protection against short circuits.

(3) Thermal protection against dangerous overloads. (Loading by Copper Temperature.)

All the thermal capacity of the transformer is made available, SAFELY . . . ideal for short-time overloads . . . conserves Critical Materials.

Ratings: 300—1000 kv-a; 50,000 kv-a breaker; 13,200—33,000 volts primary; 4160 volts secondary.

For complete information, call your Westinghouse Office or write for Descriptive Data 48-150, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-70402



CONVENTIONAL SUBSTATION—with 43 components, takes up more than three times the space required by the new CSP Power Transformer.

THE CSP LIGHT-DUTY POWER TRANSFORMER:

- **Saves man-hours**—simplifies ordering, installation and maintenance.
- **Saves space**—occupies less than one-third the space of a conventional substation.
- **Saves materials**—smaller and lighter than conventional substation. Hipersil* cores save electrical steel.
- Is completely protected against burnouts.
- Is completely protected against lightning.
- Is easily moved.

* Registered trade-mark, Westinghouse Electric & Manufacturing Co., for HIgh PERmeability SILicon steel which carries ⅓ more flux.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

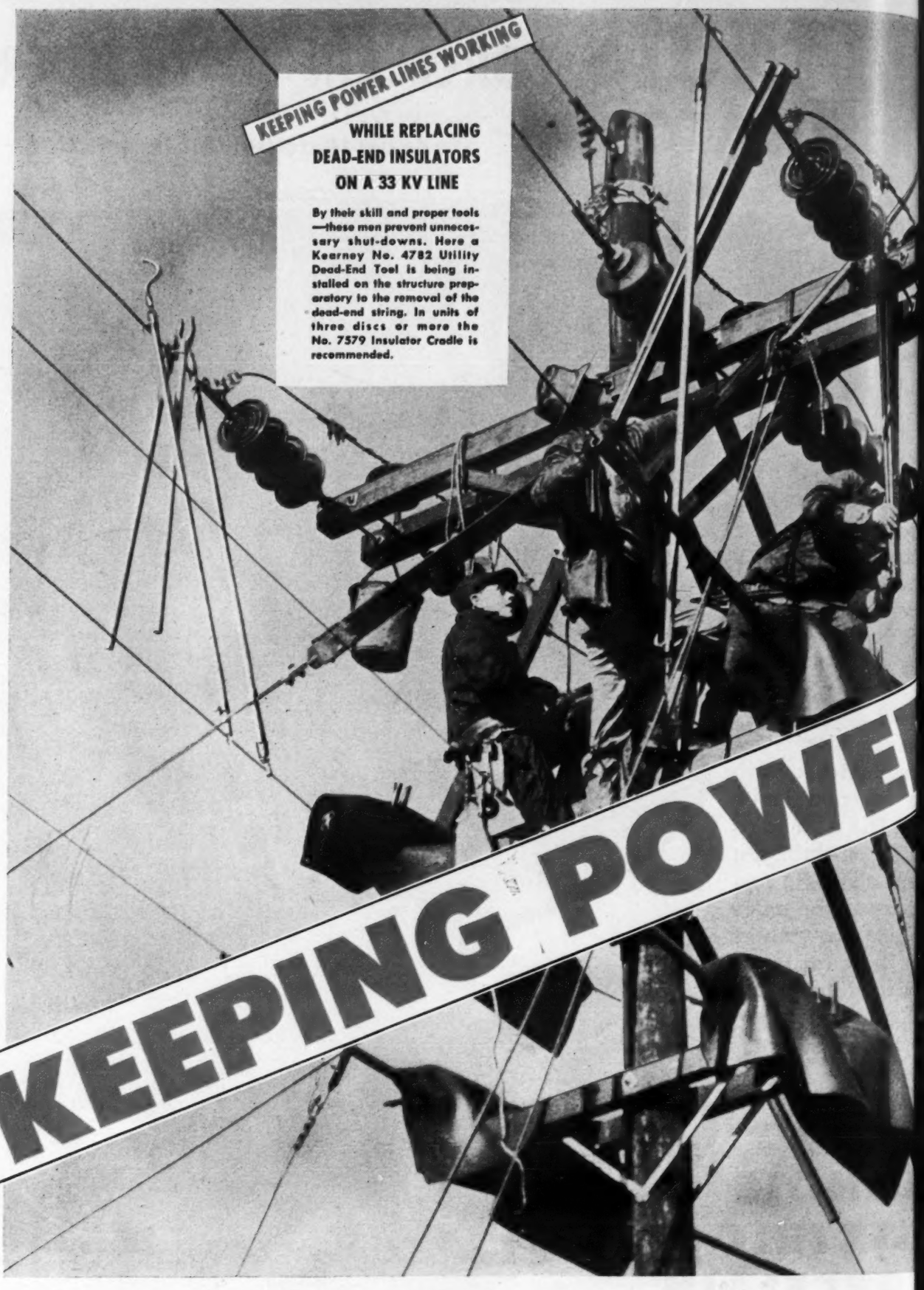
LLINOIS PORCELAIN WIREHOLDER INSULATORS • • • *insure safe house service connections*

Made in sufficient yles and sizes to eet all require- ents, these dry ocess wireholders ave rounded cor- ers to prevent in- ry to the wire sulation. The rews with deep, harp threads for sy installation, e fastened into e insulators ith non-shrinking etal alloy. No rust reaks on the sides buildings will oc- r. Wet process orcelain supplied special order. rite for samples nd prices.

•

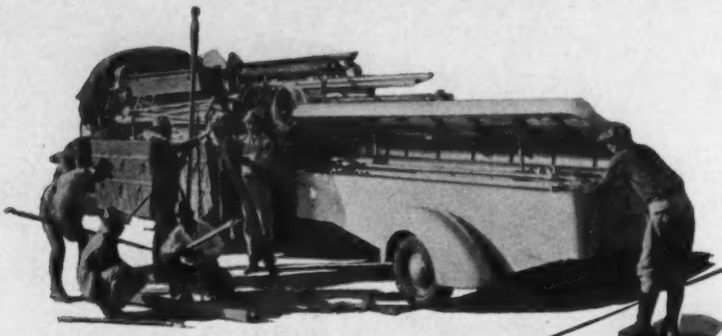
LLINOIS ELECTRIC PORCELAIN COMPANY

Macomb, Illinois


KEEPING POWER LINES WORKING
WHILE REPLACING
DEAD-END INSULATORS
ON A 33 KV LINE
By their skill and proper tools —these men prevent unnecessary shut-downs. Here a Kearney No. 4782 Utility Dead-End Tool is being installed on the structure preparatory to the removal of the dead-end string. In units of three discs or more the No. 7579 Insulator Cradle is recommended.
KEEPING POWE

MANUFACTURED BY THE JAMES R. KEARNEY CORP

THE BETTER THEIR "HOT" TOOLS
THE BETTER "HOT" CREWS WORK



INES WORKING

with KEARNEY Hi-LINE TOOLS and ACCESSORIES

YOUR "Hot Crews" know that with better Hi-Line Tools they can do better jobs in keeping power lines working . . . whether in supplying vital continuity of service to Army, Navy or Maritime projects or to other defense or farm projects . . . They know, too, that with better tools, they can do better and safer jobs, whether in making emergency repairs—replacing insulators—pin or suspension type—straight line or dead-ends, changing crossarms or poles, or other such important jobs.

As pioneers in the manufacture and development of Hi-Line Tools and Accessories, the Kearney Corporation offers a complete line of hot-line equipment—tested, safe and fully guaranteed for particular jobs. As scores of hot stick gangs will tell you—Kearney puts out the best that money can buy . . . And any Kearney Representative will be glad to show you this equipment—or write for details.

FREE—TO YOUR HOT STICK GANG

Here's our offer to the boys who "work 'em hot"—to keep power lines working . . . a handy pocket-size booklet with 25 pages devoted to descriptions and illustrations of important hot jobs . . . a page of important safety hints . . . 60 pages showing modern Kearney Hi-Line Tools and Accessories . . . Get a supply for your "Hot Stick Gang" — FREE. Just write, today.

ION JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. 4236 CLAYTON AVE., ST. LOUIS, MO.

The Mark of Quality Products

In the heat of every fight a **CONTINENTAL-DIAMOND** *produc*
fights side by side with every soldier, sailor and marin

70° below zero in the Stratosphere; 130° above zero on the desert; radi sets must function if our fighting forces are going to hold hard won gains If the electrical insulation fails, the radio fails and the fight may be lost But DILECTO laminated plastic insulation has been developed by C-D engineers to stand extremes of temperature, humidity and physical abuse so these vital ears of our armed forces DO NOT FAIL.

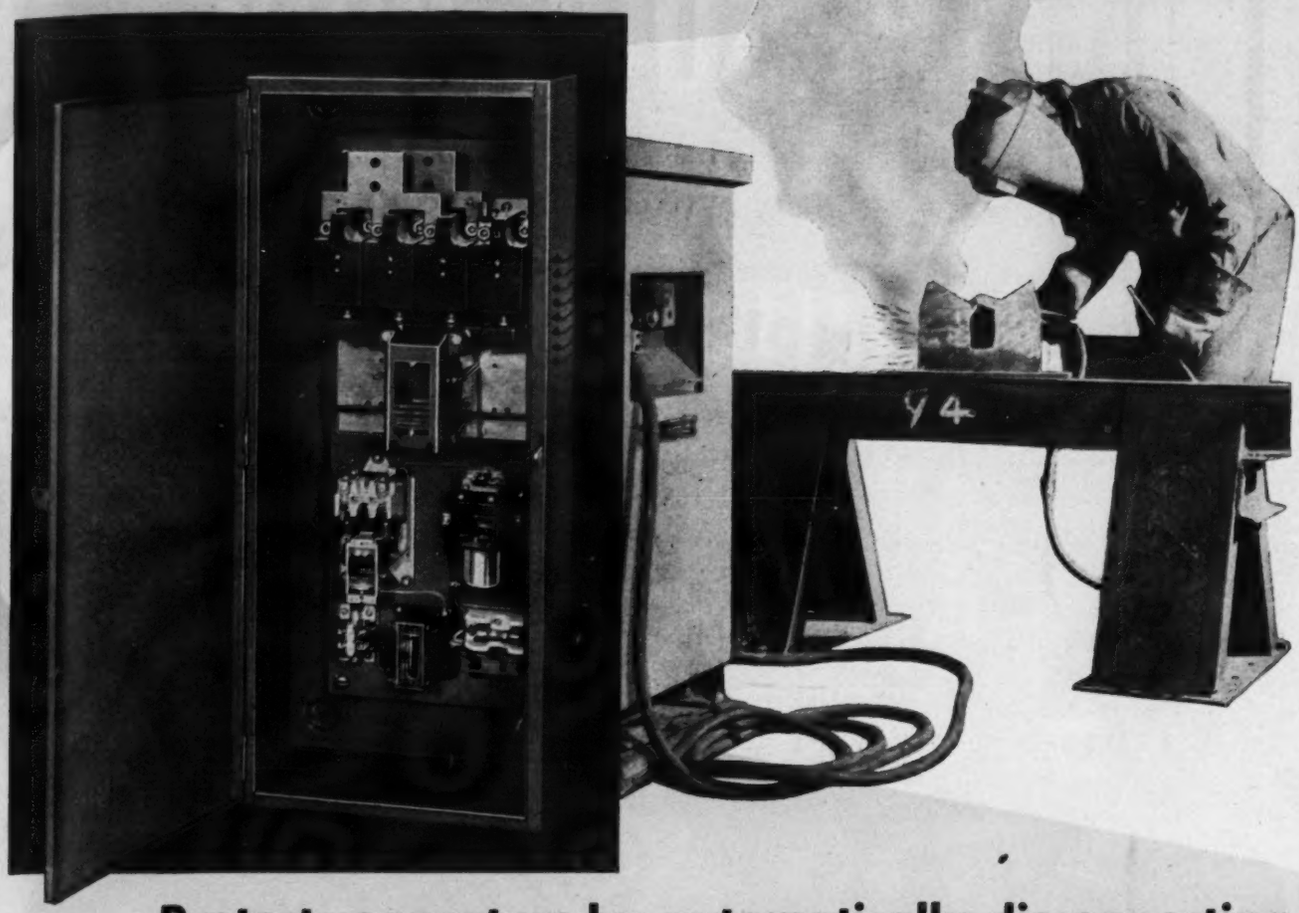
Almost fifty years of research, trial, experiment, and application experi ence with radio and electrical insulating materials are represented b DILECTO laminated plastics. That's why they don't fail when the going is tough.

You can build this same security into your products NOW to help th war effort...TOMORROW to meet peace-time competition. Catalog DO- gives complete technical data, electrical and mechanical, on DILECTO May we send you a copy?

DISTRICT OFFICES:
New York • Cleveland • Chicago • Spartanburg, S.C.
West Coast Representative:
Marwood, Ltd., San Francisco
Sales Offices in principal cities

Continental-Diamond FIBRE COMPANY
Established 1895 . . Manufacturers of Laminated Plastics since 1911 — NEWARK • DELAWARE

SQUARE D *Announces*
SAFETY CONTROL FOR A·C· ARC WELDERS



Protects operators by automatically disconnecting welding transformer when arc is broken . . . .

HIGH open circuit voltages of A. C. arc welders (transformer type) create a definite hazard to operators. Physical contact from electrode to grounded metal surfaces (when not welding) is sometimes serious.

Square D's new class 8992 safety panels eliminate this hazard by automatically disconnecting the welder transformer after the arc is broken. The transformer is automatically reconnected the instant the operator touches the electrode to the work. Thus, the arc is struck with no delay. There is no loss in operating speed or efficiency.

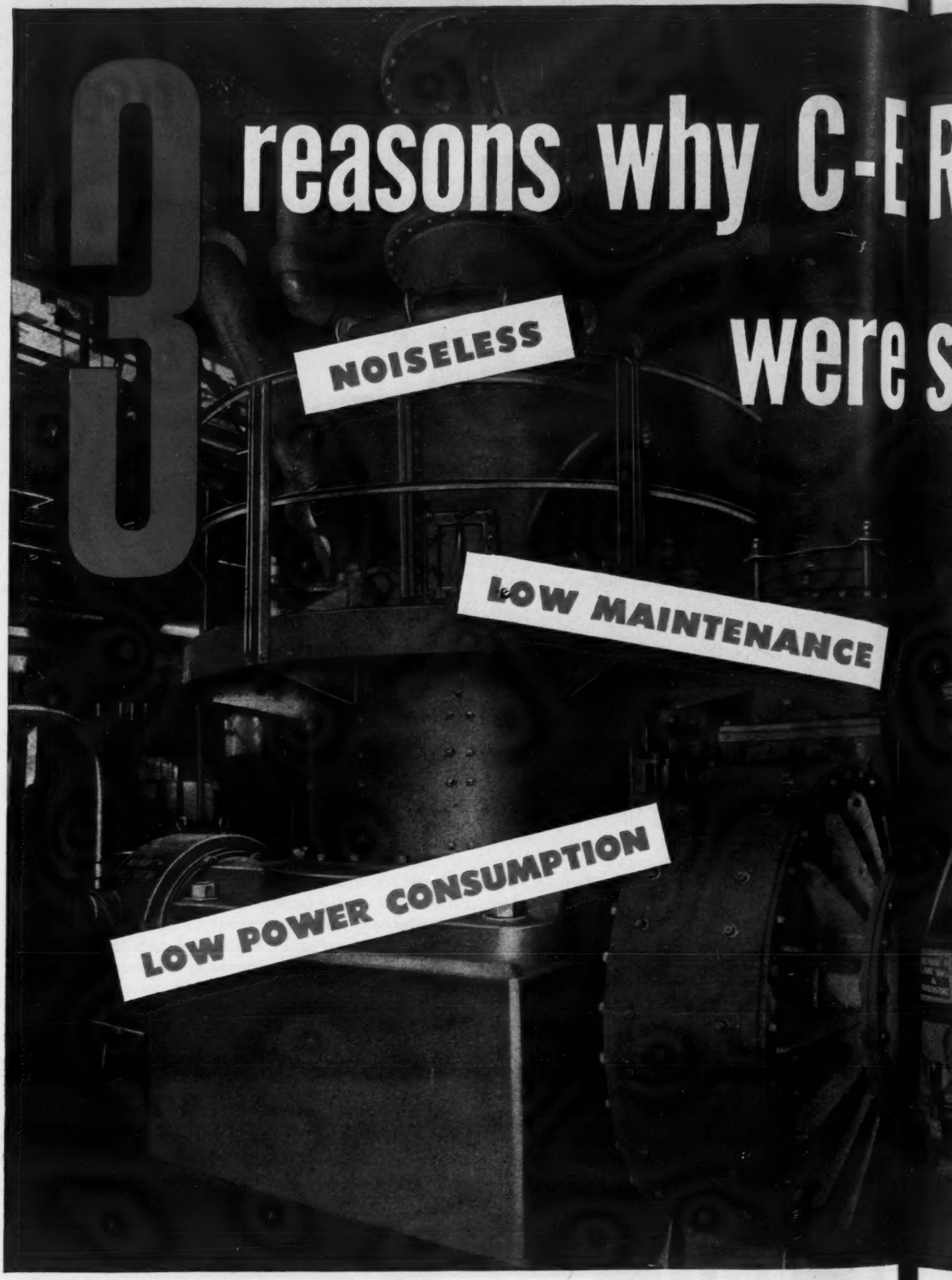
There is an economy angle, too. When Square D safety panels are used, the welding transformer primary circuit is connected to the power line only while the arc is held. Substantial saving in power is effected when a number of welders are used on a single power system and the power factor is improved.

These new safety panels can be used with any make or model of A. C. transformer type arc welder. External connections are simple and internal connections of the welder need not be disturbed.

ELECTRICAL EQUIPMENT • KOLLSMAN AIRCRAFT INSTRUMENTS

SQUARE D COMPANY

DETROIT • MILWAUKEE • LOS ANGELES


3 reasons why C-E
were s
NOISELESS
LOW MAINTENANCE
LOW POWER CONSUMPTION

Raymond Bowl Mills selected for more than

50%*

of all pulverizer capacity for boilers ordered since January 1st, 1942!

Certainly there are other reasons for the remarkable rise of the C-E Raymond Bowl Mill in a brief period of eight years to its present position of preference among power engineers.

Yet again and again we find many users of the Bowl Mill emphasizing its exceptionally quiet operation, its low maintenance costs and its high output per kw-hr. They seem to take for granted the ability of the mill to turn out the quantity and fineness of coal desired because with the Bowl Mill this becomes a matter of routine performance. But apparently they can never quite accustom themselves to the idea that a coal pulverizer can be as quiet as the Bowl Mill or cost so little to operate and maintain.

These three big advantages attested to as they are by such pronounced customer preference merit the consideration of every engineer who influences the selection of pulverizer equipment.

*Percentage based on capacity of pulverizers sold for direct firing of boilers for 16 month period ending May 1, 1943. Based on statistics of pulverizer sales as compiled by U. S. Government and American Boiler and Affiliated Industries. A-748

COMBUSTION ENGINEERING

200 MADISON AVENUE, NEW YORK, N. Y.

A miracle metal... Magnesium serves a vital wartime need in tracer ammunition, parachute flares, and illuminating signals. To reduce this difficult, extremely hazardous metal to powder, Magna Manufacturing Company developed special machinery and precision processes. Now, in three Magna plants... the largest facilities of their kind... we reduce Magnesium to a uniform dust in compliance with rigid U.S. Army and Navy standards.

BUT TOMORROW...

The facilities that Magna perfected open new possibilities for the utilization not only of magnesium but also *all* other types of disintegration-resisting metals and other materials such as ceramics, plastics and pigments.

Magna capacities are today entirely occupied with production for victory. However, Magna engineers are prepared to council forward looking industries on the potentialities of powdered metals and other materials in postwar product planning.

An Invitation...

Manufacturers, design engineers, and technicians are invited to investigate Magna facilities and to work experimentally with our staff to develop new and better products... through the practical disintegration of desirable materials heretofore unavailable in powdered form. Your inquiry is invited.

MAGNA

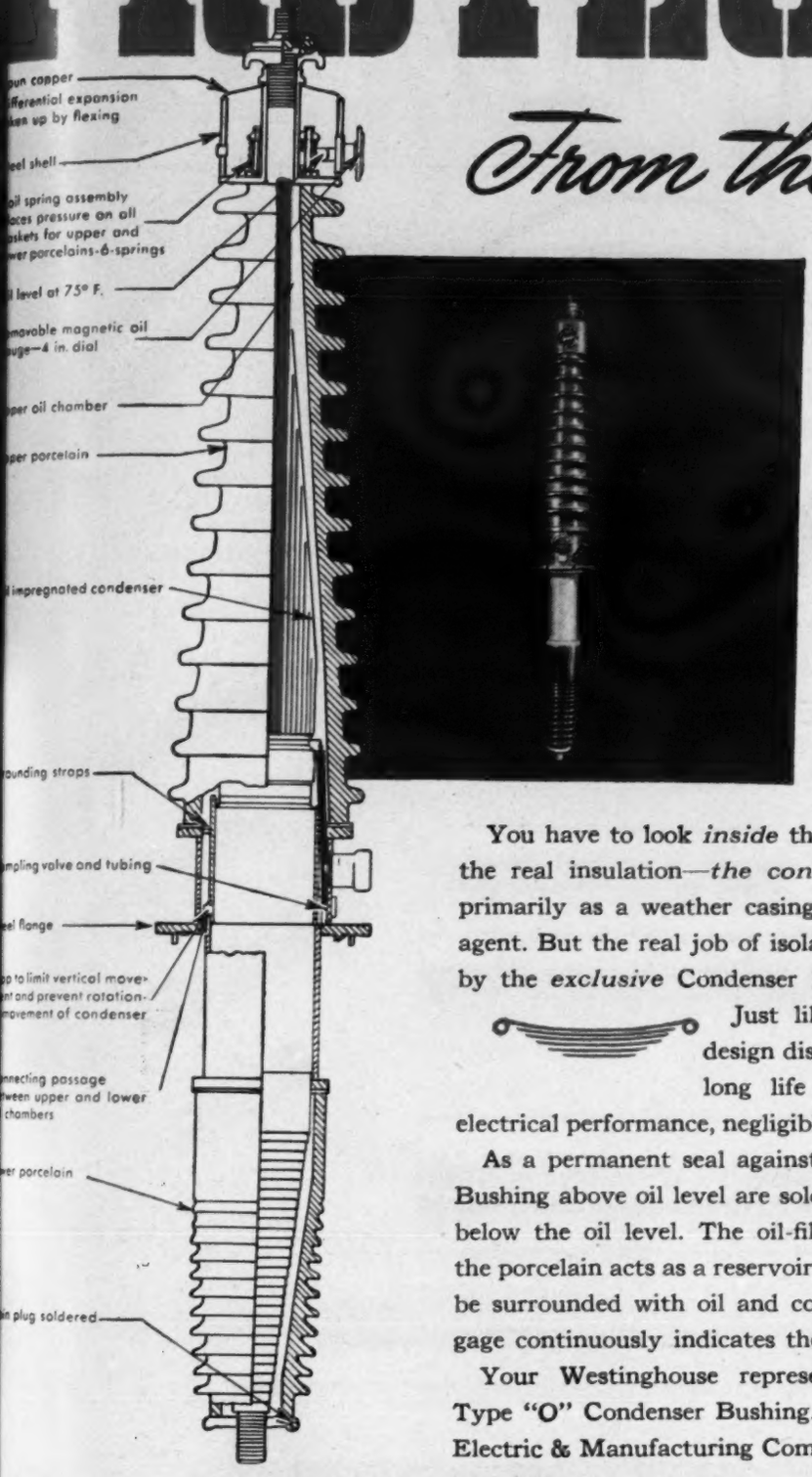
MANUFACTURING COMPANY, INC.

MANUFACTURERS OF MAGNAFLAKE METAL POWDERS

444 MADISON AVENUE, NEW YORK 22, N. Y.

PROTECTED

From the inside out



Westinghouse supplies Type "O" Oil-pregnated Condenser Bushings for rvice voltages from 92 to 230 kv. Type O" Bushings of the same voltage and rrent ratings are interchangeable be-ween oil circuit breakers and large wer transformers.

THE WESTINGHOUSE OIL-IMPREGNATED CONDENSER BUSHING

You have to look *inside* the Type "O" Condenser Bushing to find the real insulation—*the condenser*. The outside porcelain serves primarily as a weather casing; the oil filling as a secondary sealing agent. But the real job of isolating high voltage from ground is done by the *exclusive* Condenser Insulation.

Just like the leaf springs in your car, this design distributes stresses uniformly. This means long life for the dielectric material, uniform electrical performance, negligible radio interference and minimum size.

As a permanent seal against moisture, all joints of the Type "O" Bushing above oil level are soldered or brazed, while gaskets are used below the oil level. The oil-filled space between the condenser and the porcelain acts as a reservoir insuring that the condenser will always be surrounded with oil and completely impregnated. A magnetic oil gage continuously indicates the level of the oil.

Your Westinghouse representative has further details on the Type "O" Condenser Bushing. Consult him, or write: Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., Dept. 7-N.

J-60537

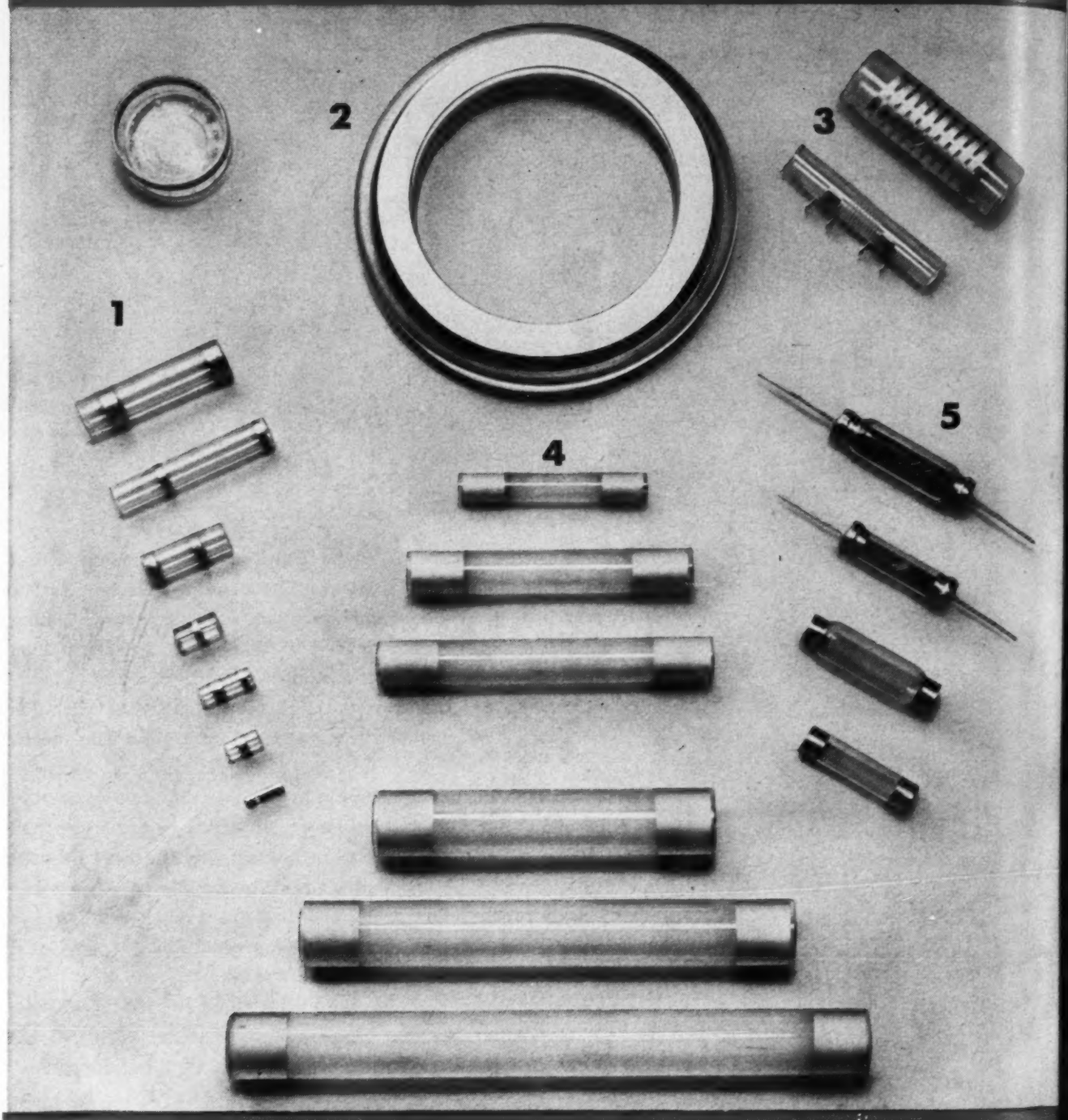
Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

CONDENSER BUSHINGS

CORNING GLASS RESEARCH ANNOUNCES NEW

HERMETIC



1. Radio Apparatus Bushings. 2. Ring Insulator. 3. Coil Forms. 4. Envelopes for Condensers and Power Resistors. 5. Small Envelopes for Condensers and Resistors.

METALLIZING ON GLASS!

THE METALLIZING IS AN INTEGRAL PART OF THE GLASS ITSELF, MAKES POSSIBLE PERMANENT HERMETIC SEALS

SOLDERS AS EASILY AS BRASS OR COPPER

CAN BE APPLIED TO WIDE RANGE OF CORNING'S STANDARD AND EXTRA-STRONG GLASSES

HERE'S an easy solution to difficult assembly problems on units which must be sealed against leakage of air, oil or water. Corning's metallizing method is a big step forward in the art of applying metal to glass. Metallizing becomes part of the glass itself . . . the answer to your hermetic sealing problems. The metallized layer solders easily and is not harmed by normal soldering temperatures. Parts can be soldered to it by ordinary soldering iron, soft air-gas flame or induction heating. And it is tinned to prevent corrosion of the metal during storage and to make soldering easy.

Best of all, Corning type metallizing can now be applied to an extremely wide range of Corning's high and low expansion glasses. Where extreme resistance to thermal or mechanical shock is required, it can be applied to strengthened glass. Where electrical characteristics are of prime importance, it can be applied to some of the special low-loss glasses such as Corning's "Pyrex" Multiform Glass No. 790.

A few of the interesting applications where metallized glass has already been used to real advantage are shown on the opposite page. If you, too, have the job of insulating current-carrying leads or terminals on hermetically-sealed apparatus, do this now: Fill out and mail coupon today for full details on the improved metallizing method developed by Corning Glass Research!

MAIL COUPON TODAY FOR COMPLETE DETAILS!

Corning Glass Works
Insulation Division, Dept., W-81,
Corning, N. Y.

Please send me full details of improved method of metallizing on glass.

Name.....

Company.....

Street.....

City.....*State*.....

Pyrex Insulators
BRAND

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.

Dunco "Memory" Types

THE RELAYS THAT NEVER FORGET

Struthers-Dunn Mechanical Latch-in, Electrical-Reset Relays have fool-proof memories. They indicate what operations have been made on your equipment. They guard against mistakes. The contacts "remember" unfailingly which coil was last energized—*by remaining in position until they are released by energizing the other coil.*

Hundreds of jobs throughout industry are being performed better, more efficiently because these Struthers-Dunn Memory Relays permit of no forgetting. They are made in both the large (Series 5) and the "midget" (Series 51) sizes as well as aircraft types, and with practically any contact or mounting arrangement. You'll find these Relays described in detail on Pages 14F, 15F, and 16F of the Dunco Catalog and Relay Data Book (see below).

WRITE FOR CATALOG

DISTRICT ENGINEERING OFFICES: ATLANTA • BALTIMORE • BOSTON • BUFFALO
CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • HARTFORD
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ST. LOUIS • SAN FRANCISCO • SEATTLE • SYRACUSE • TORONTO • WASHINGTON

STRUTHERS-DUNN, Inc.

1321 ARCH STREET, PHILADELPHIA, PA.

T'S THE *PORCELAIN* THAT INSULATES

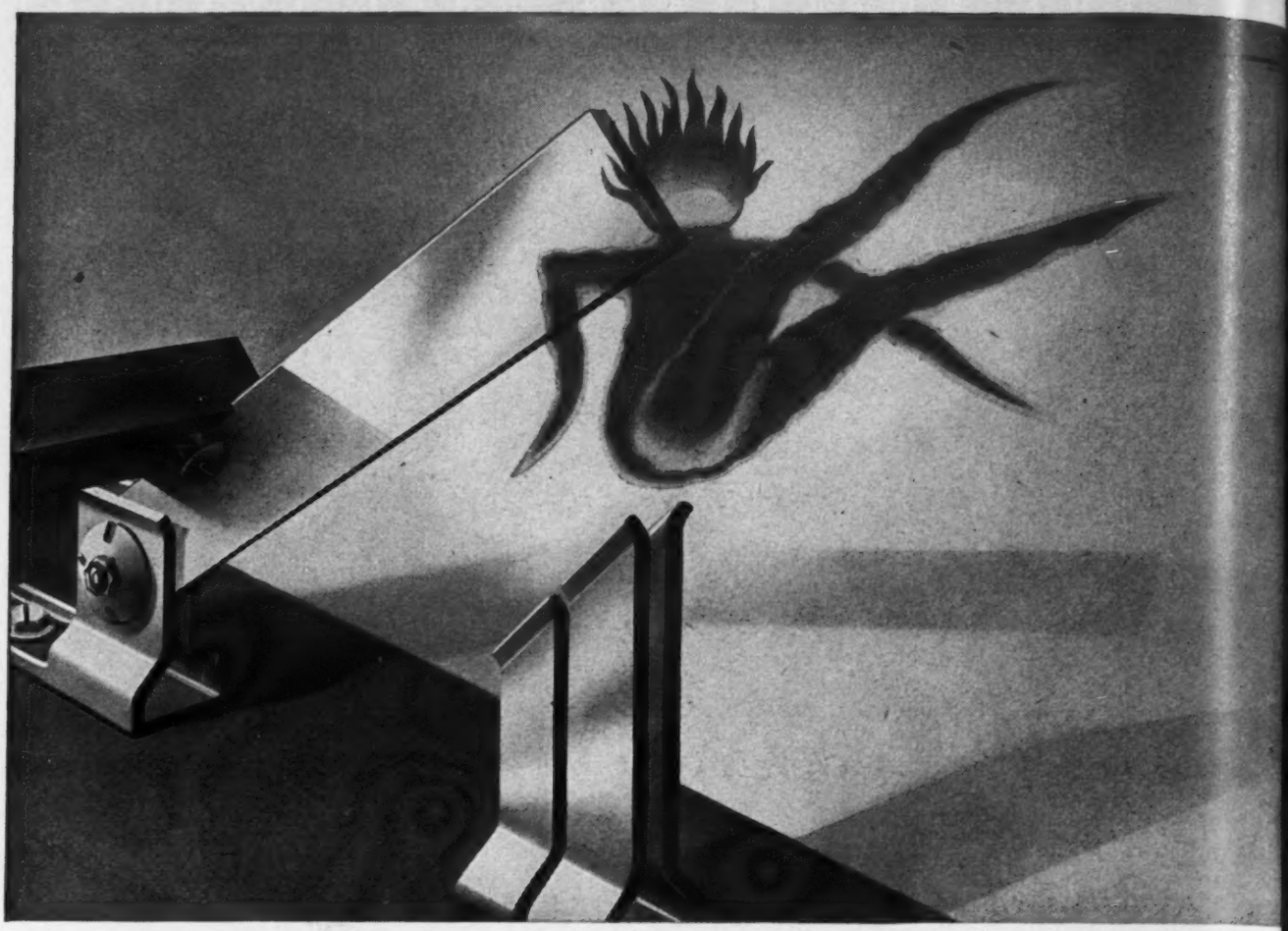
PROVING GROUND FOR INSULATORS . .

The temperament of the Lapp organization is that of dissatisfaction with existing methods, existing designs. It is this spirit which produced the Line Post and which made necessary the Lapp laboratory, a corner of which is photographed above. No sanctum sanctorum, this laboratory is truly an engineers' workshop, in continuous day-to-day use, testing, discarding, proving new designs. As we learn how to build better insulators, we build them. Meanwhile, we feel secure in our claim that today's Lapp insulators are adequately suited to today's needs, that you can do no better than to insulate your lines with Lapp. Lapp Insulator Co., Inc., Le Roy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators



hot arcs get the point Quick!

Arcs burn with terrific heat when they leap between opening contacts. The heavier the load... the hotter they burn. Switch contacts get badly pitted and burnt, unless the arc is both controlled and extinguished, *quick*.

Westinghouse Safety Switches eliminate this source of trouble. The diamond-pointed jaw carries the arc outside the contact area assuring long contact life.

On Safety Switches, 575 and 600 volts, Westinghouse adds another protective plus—the "De-ion" arc quencher. This exclusive feature draws the arc up into the grids—divides and extinguishes it in the blink of an eye.

These advantages mean better, more dependable protection. Contacts stay clean, last longer. Time-outs for maintenance and inspection reduced.

Protect your important circuits with Westinghouse Safety Switches. Ratings up to 1200 amps, 600 volts. Call your Westinghouse representative today. Westinghouse Elec. & Mfg. Co., E. Pittsburgh, Pa., Dept. 7-N.

J-21266

LIKE THIS

Diamond-pointed break jaws confine arcing to the point... force the arc to break outside the current carrying areas. Contact surfaces stay clean, don't pit and burn.

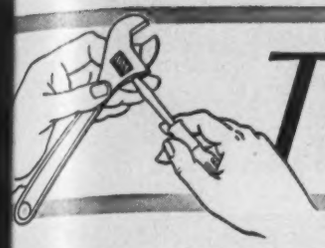
NOT LIKE THIS

When ordinary safety switches are opened, the arc leaps across the contact areas ... along the jaw and blade. It hangs on longer, burns and pits the contact surfaces.

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

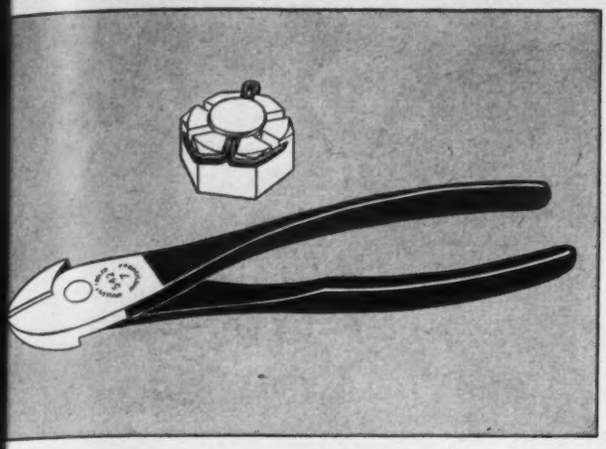
SAFETY SWITCHES



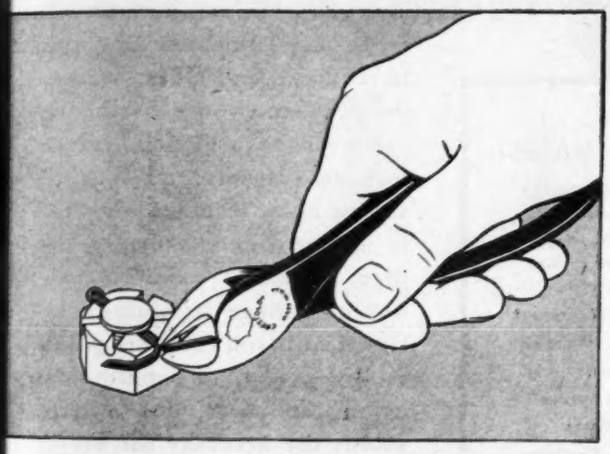
TOOL NOTES

"How To Do It" Information For Crescent Tool Users

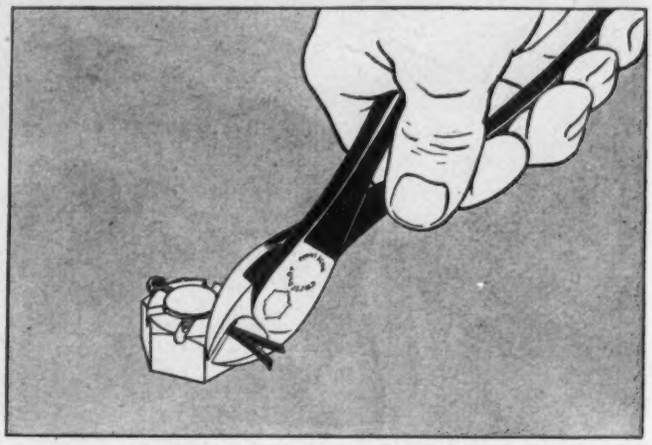
No. 13 . . . . . HOW TO REMOVE COTTER KEYS



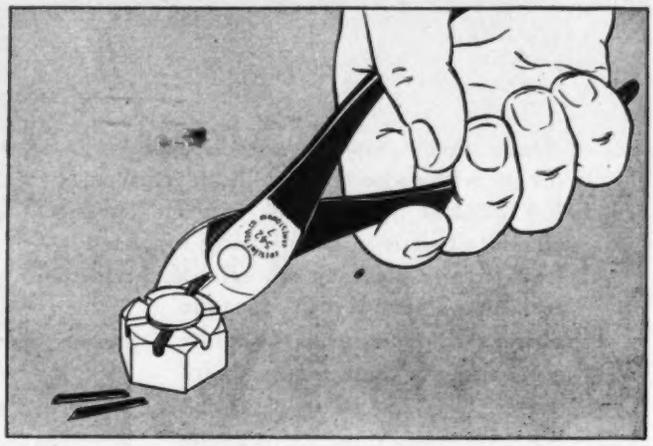
he following is a simple, effective and workmanlike ethod of removing cotter keys. It is not safe practice reuse these keys and this method makes it impossi- e. Crescent's Heavy Diagonal Pliers, No. 542, should used for this purpose.



irst, straighten out the spread ends sufficiently to rmit cutters to "bite" both pieces at one time as own in following illustration.



With cutters close to nut, as shown above, sever spread ends with a single cut.



Now grip the head or "eyed" end of the cotter key as shown above and with a sideways motion, pry the cotter key out. *Don't attempt to pry it out without first cutting off the spread ends.*

MAIL THE COUPON . . . for Free Reprints of this series of informative ads. Please indicate whether you want them for bulletin board use, or punched for 3-ring binder.

CRESCENT TOOL COMPANY, JAMESTOWN, N. Y.

CRESCENT TOOLS
Give Wings to Work

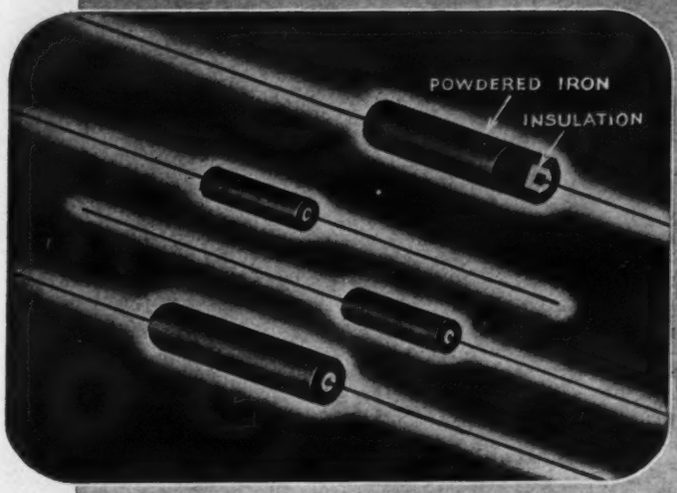
Crescent Tool Co., Jamestown, N. Y. D-4
Please send your "TOOL NOTES" Series
☐ for Bulletins ☐ for 3-ring binder

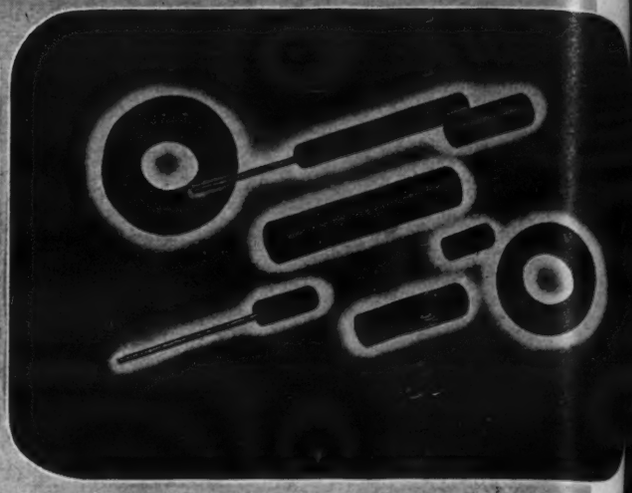
Name _____

Address _____

City _____ *State* _____

TWO IMPORTANT NEW IRON CORE DEVELOPMENTS





IRON CORES FOR CHOKE COILS

These little units have been designed for use with audio chokes, "hash" chokes, R-F chokes and various others They consist of an iron core having insulated leads and resembling the axial lead-type resistors. These cores reduce the physical dimensions of the choke coil, and the iron serves to increase the "Q". The insulated leads serve as connections to the coil and permit point-to-point wiring. Available in a complete line for present day requirements.

* * *

OTHER STACKPOLE IRON CORES include a complete line for modern high frequency equipment from 40 meg. to 175 meg. and higher; insulated cores, high-resistivity cores; molded iron transformer cores, and various others. Samples to your specifications gladly submitted

STACKPOLE MAKES:

Brushes for all rotating equipment
Carbon, Graphite, Molded Metal and Composition Contacts
Powder Metallurgy Components
Bearings • Anodes
Electrodes
Power Tube Anodes
Brazing Blocks
Welding Rods, Electrodes and Plates
Rheostat Plates and Discs
and various other molded items.

HIGH-RESISTIVITY CORES

Where cores having high unit resistivity are needed, Stackpole offers a special material showing resistance of practically infinity. Cores of this material are recommended for applications where a resistance of 150 megohms or greater is required, and where voltages do not exceed the breakdown value. The insulation reduces leakage currents and their resultant noise troubles when coil is located on or touching this high resistance core; possibilities of voltage breakdown between coils and cores are greatly reduced; and, in applications using cup cores, this material avoids the necessity for heavily insulated lead wires.

STACKPOLE CARBON CO.
St. Marys, Pennsylvania

STACKPOLE

MOLDED METAL POWDER AND CARBON PRODUCTS

An Entire System Depends on a Forging

t present the forging industry is all-out for war. owever, BTC Forged Hi-Line Hardware has een ruled too vital to suspend – even tempora- y. A perfect example is shown in the Forged eel pins illustrated above.

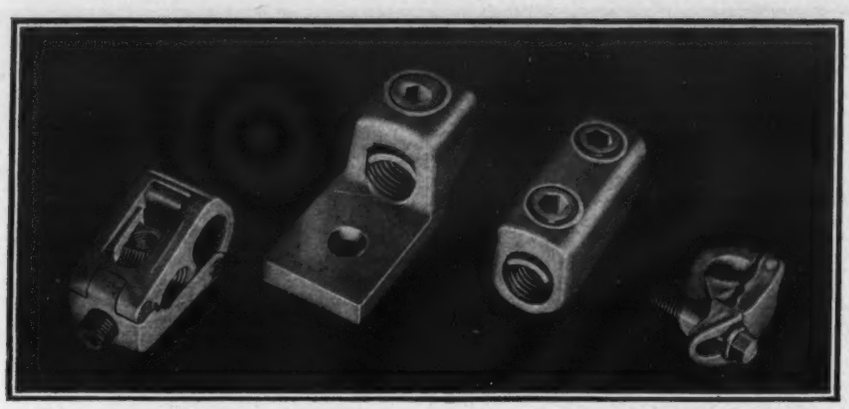
Your heaviest hook-up is only as strong as the pins that connect the insulators. These small pins are always steel. Ask any insulator manufacturer.

Through Your Insulator Manufacturer Only

BTC

Transmission Line Hardware

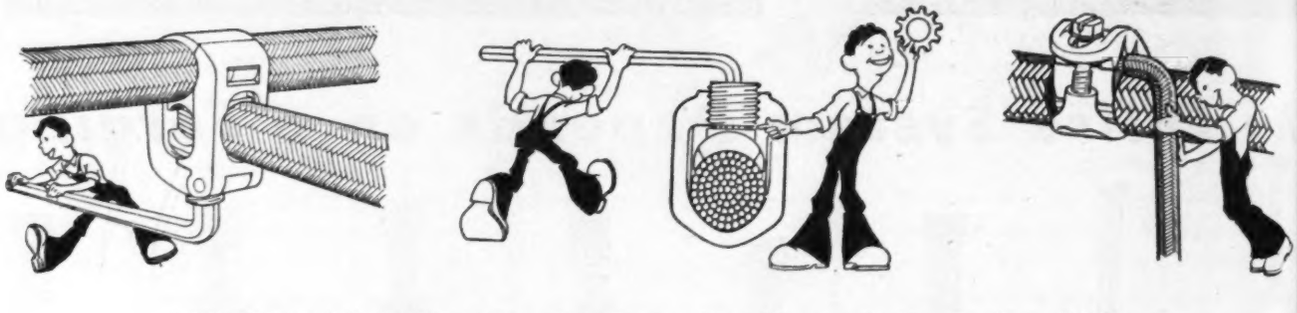
HE BREWER-TITCHENER CORPORATION – CORTLAND, NEW YORK



4 DEPENDABLE ANSWERS to 90% of Your Wiring Problems

The Famous T&B Lock-Tite and Hinjon, Jr. Lugs, Taps and Connectors

A SMALL ASSORTMENT of these compact T&B Pressure Connectors of overlapping wire sizes insures quick help to electricians. Each fitting takes a variety of Conductor sizes. Because they are pressure (solderless) connectors, they install in a flash with key wrench or screw driver.



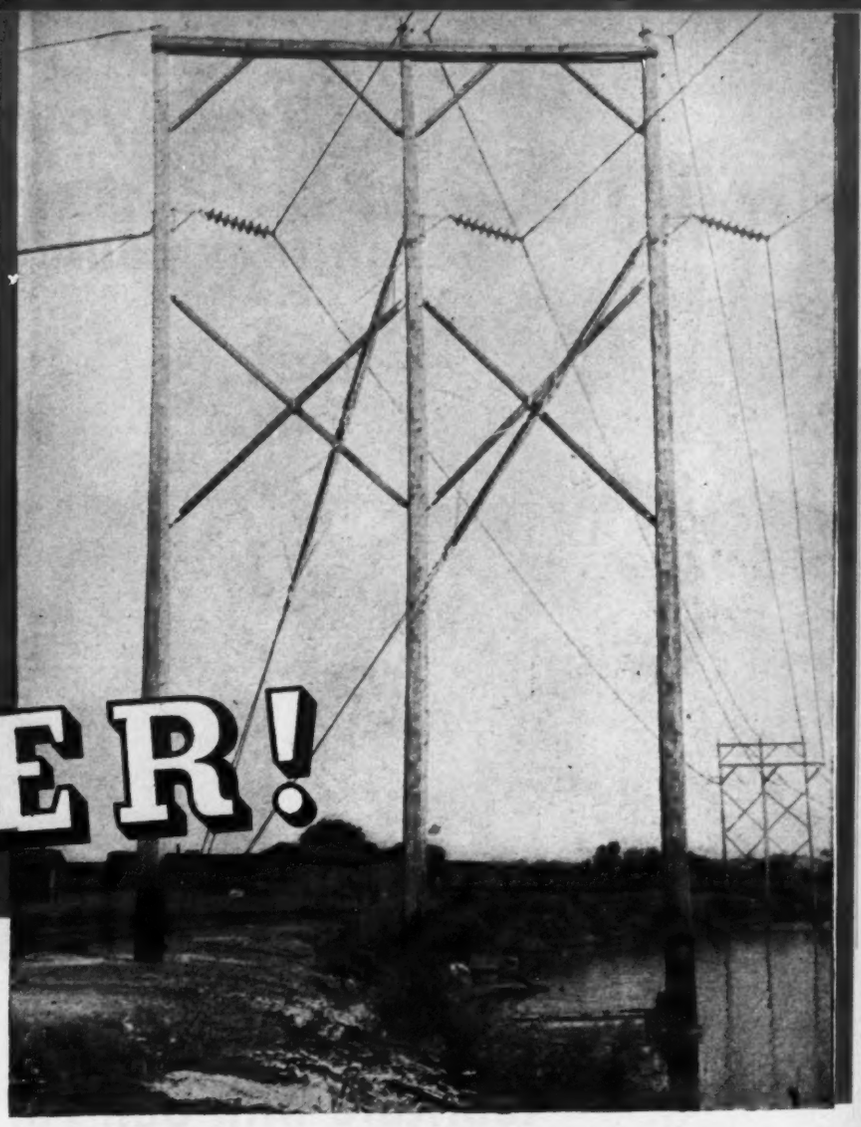
These T&B Lock-Tite Lugs and Taps will take any type of wire, cable or tubing. The conductor is locked-tight by the curved, serrated saddle driven by a rugged pressure screw. Streamlined to save space and cost. Maintenance costs are reduced, because each is completely salvageable. Approved. Patented. Made by the makers of Wedge-On and Sta-Kon Pressure Terminals.

Under the T&B Plan, all T&B products are sold only through T&B Distributors who reduce the manufacturer's selling costs, thereby reducing the cost of all electrical equipment to the user. Your nearby T&B Distributor is a Lock-Tite specialist. Why not get in touch with him?

Send for Technical Folder and Bulletin "Quick Help on Your Maintenance and Repair Jobs."

THE THOMAS & BETTS CO.
INCORPORATED
MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1899
ELIZABETH 1, NEW JERSEY
In Canada: Thomas & Betts Ltd. Montreal

RODUCTION BEGINS WITH POWER!



Insure

DEPENDABILITY IN POWER LINE SERVICE WITH LIFE-SPAN DECAY-RESISTANT POLES!

LIFE-SPAN

Full Length Tox-itized
CEDAR POLES

Sold by the Following:

B. J. CARNEY & CO.
Spokane Minneapolis

SCHAEFER-HITCHCOCK CO.,
Sandpoint, Idaho, Supplier for Joslyn

LEAVITT-NAUGLE CO.
Spokane, Wash.
205 West Wacker Drive, Chicago, Ill.

NAUGLE POLE AND TIE CORP.
Minneapolis, Minn.

PAGE AND HILL CO.
Minneapolis, Minn.
50 Church St., New York, N. Y.

The job of translating raw materials into terms of production depends on steady, uninterrupted power flow—power that must be guided to production lines by poles. How dependably these poles perform—not only in meeting today's quotas but in meeting the anticipated needs of the future—depends on your judgment and care in their selection and purchase. For extra years of trouble-free service—specify Life-Span—the pole with a future! In Life-Span poles, full-length tox-i-tizing, plus regular creosote butt treatment, insures strength and soundness that will last! Build your lines secure against future blackouts with Life-Span Cedar poles.

IMPORTANT!

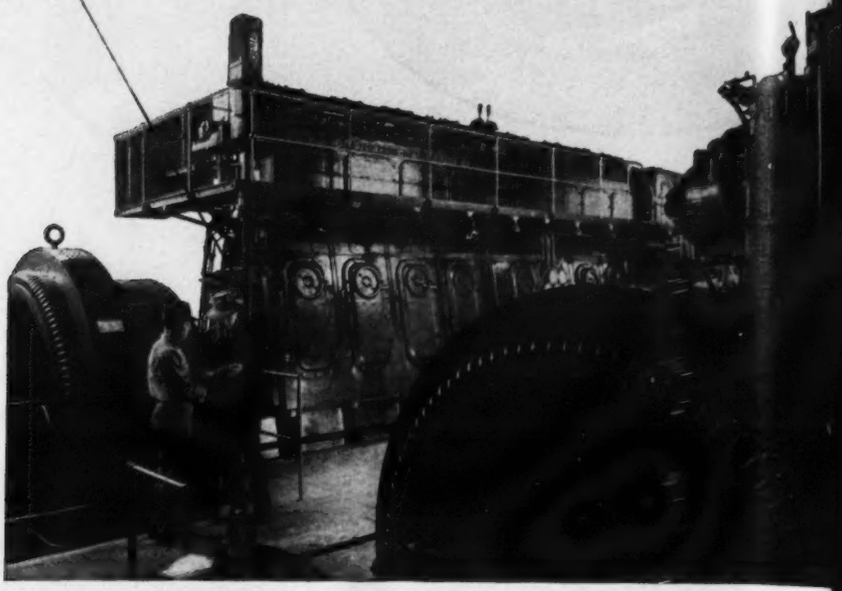
Experiments started four and five years ago are revealing interesting facts regarding the efficiency and permanence of the Life-Span method of treatment. What these facts are and what they mean in terms of pole service and economy will be described in the near future. Watch for information!

CONSOLIDATED

TREATING CO. MINNEAPOLIS, MINN.

Treat your Diesels

as though they could never be replaced—



— lubricate with Gulf Parvis Oil

Gulf Parvis Oil provides better lubrication under today's peak-load and over-load operating conditions

YOUR Diesels are precision-built for long dependable service under norma operating conditions. But long periods of peak-load and over-load oper tion to meet heavy wartime demands for power have greatly multiplied th problem of avoiding excessive wear and shortened useful life.

Today better lubrication care is a vital necessity to head off trouble! Now more than ever, it pays to use lubricating oils that provide an extra margi of protection to Diesel cylinders, pistons, bearings and other currently hard to-obtain parts.

You insure this added protection when you put Gulf Parvis Oil in servi to lubricate your Diesels. For built into this quality oil are greater stabilit and endurance—it stands up and provides a tough film of highest lubricatin value under severe operating conditions—conditions which often cau excessive wear, below standard Diesel performance, and high maintenanc expense.

Gulf Parvis Oil is quickly available to you through 1200 warehouses locate in 30 states from Maine to New Mexico. Write or 'phone your nearest Gu office today.

GULF INDUSTRIAL LUBRICATION

GULF OIL CORPORATION
GULF REFINING COMPANY
GULF BUILDING • PITTSBURGH, PA.

Cover has been removed from the 100-ampere G Frame Nofuze "De-ion" Breaker to show how the interchangeable trip unit can be removed without disturbing other parts of the mechanism.

Interchangeable TRIP UNITS

make NOFUZE BREAKERS adaptable for war or peace

Whether in khaki or "civvies", Nofuze Breakers provide circuit protection that can be accurately fitted to job conditions.

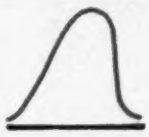
Today, when most Westinghouse Breakers are "mobilized" to protect war circuits, they are keeping current flowing *safely*, with minimum interruptions in war production.

When peace comes, with its equally great problems of conversion to civilian goods, Nofuze Breakers will permit economical and speedy change-overs. For example: In the larger frame sizes, trip units are removable and interchangeable. Thus if your conversion results in heavier or lighter loads, the present trip unit can be quickly replaced with one of the required trip rating. It's as easy as that.

Ask your Westinghouse representatives for help on *your* war circuit problems. Or write direct to: Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa., Dept. 7-N. J-60539

NOFUZE "DE-ION" BREAKERS

Prevent harmless overloads from interrupting war production.

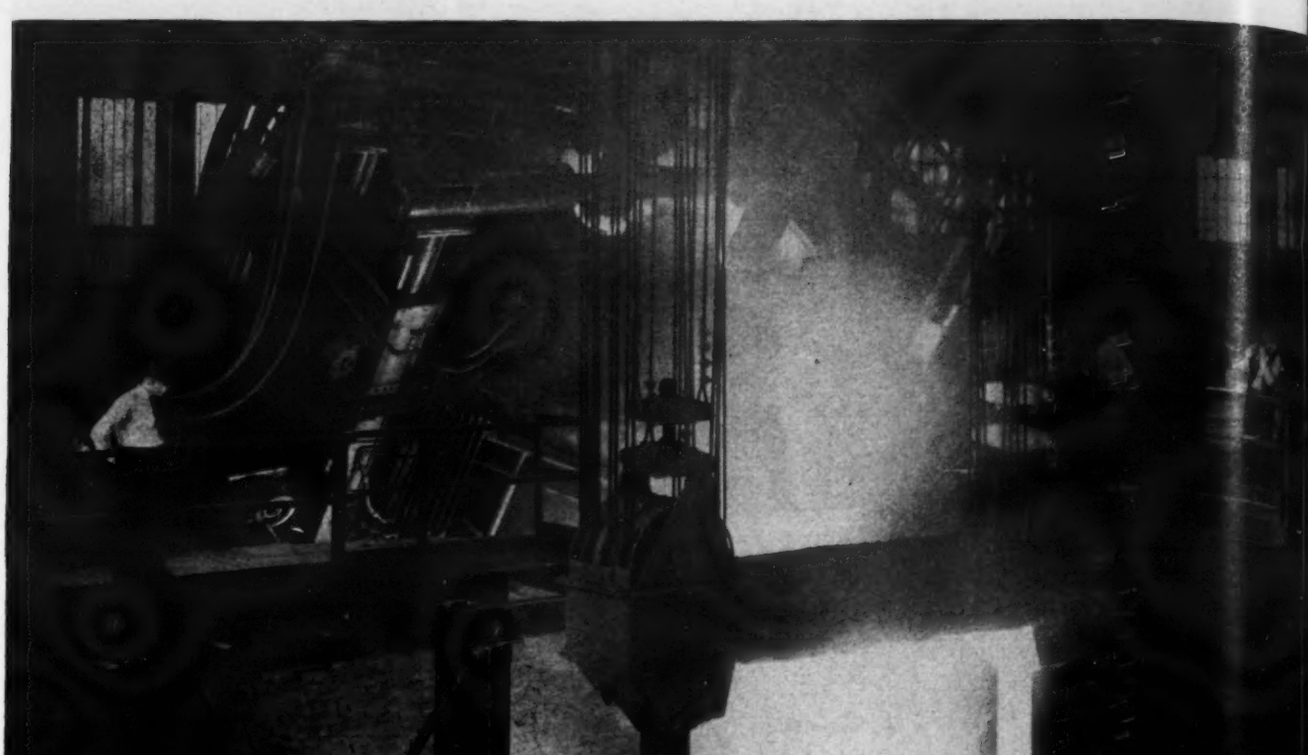


Protect circuits from dangerous overloads and "shorts".

Restore service instantly with just a flip of the switch.

Westinghouse NOFUZE CIRCUIT PROTECTION

PLANTS IN 25 CITIES ... OFFICES EVERYWHERE



Making it hot for Hitler

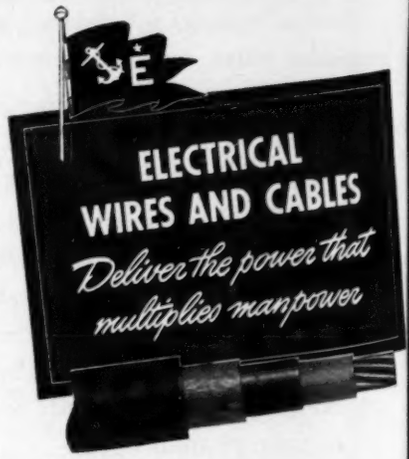
ONE of Hitler's greatest headaches is America's vast steel production—this year more by far than that of all the Axis countries combined.

The "hot seat" for Adolph is being made especially hot by America's great electric furnaces . . . for they produce the fine alloy steels that make the vital parts of our planes, guns, and ships just enough better to spell the Axis' doom.

These vitally important furnaces depend upon electric current—current which must be delivered unfailingly night and day. Only electrical wires and cables of the finest quality, of the utmost dependability, can be entrusted to this job.

We are proud that products of American Steel & Wire Company play such an important role in delivering power and light to America's vast war production machine. The quality of our electrical wires and cables is no accident. For years and years our engineering and production departments have worked for constant improvement.

And they continue to work on new ideas and developments to take care of the increased wartime demands for power and light and the ultimate conversion to peacetime requirements.



AMERICAN STEEL & WIRE COMPANY

Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors* — United States Steel Export Company, New York

UNITED STATES STEEL

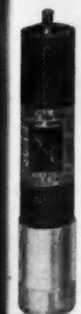
FUSE AND CONTACTOR SWITCH-GEAR FOR HIGH VOLTAGE MOTORS

Short Circuit Protection at Lower Cost—With Saving in Critical Metals

S&C Power Fuses for short-circuit protection are now being used in combination with oil-immersed contactor,—in one assembly,—on high voltage induction and synchronous motor installations.

This combination has advantages of:—

1. *Power Fuse protection with the necessary short-circuit interrupting capacities to provide fast, reliable circuit interruption when faults occur in motors or connected equipment,—and,—*
2. *Starting and stopping of the motor by means of Oil-immersed Contactors. Installation is simpler than for other types of circuit interruption and control apparatus,—less critical metal is required, costs are lower, and deliveries better.*



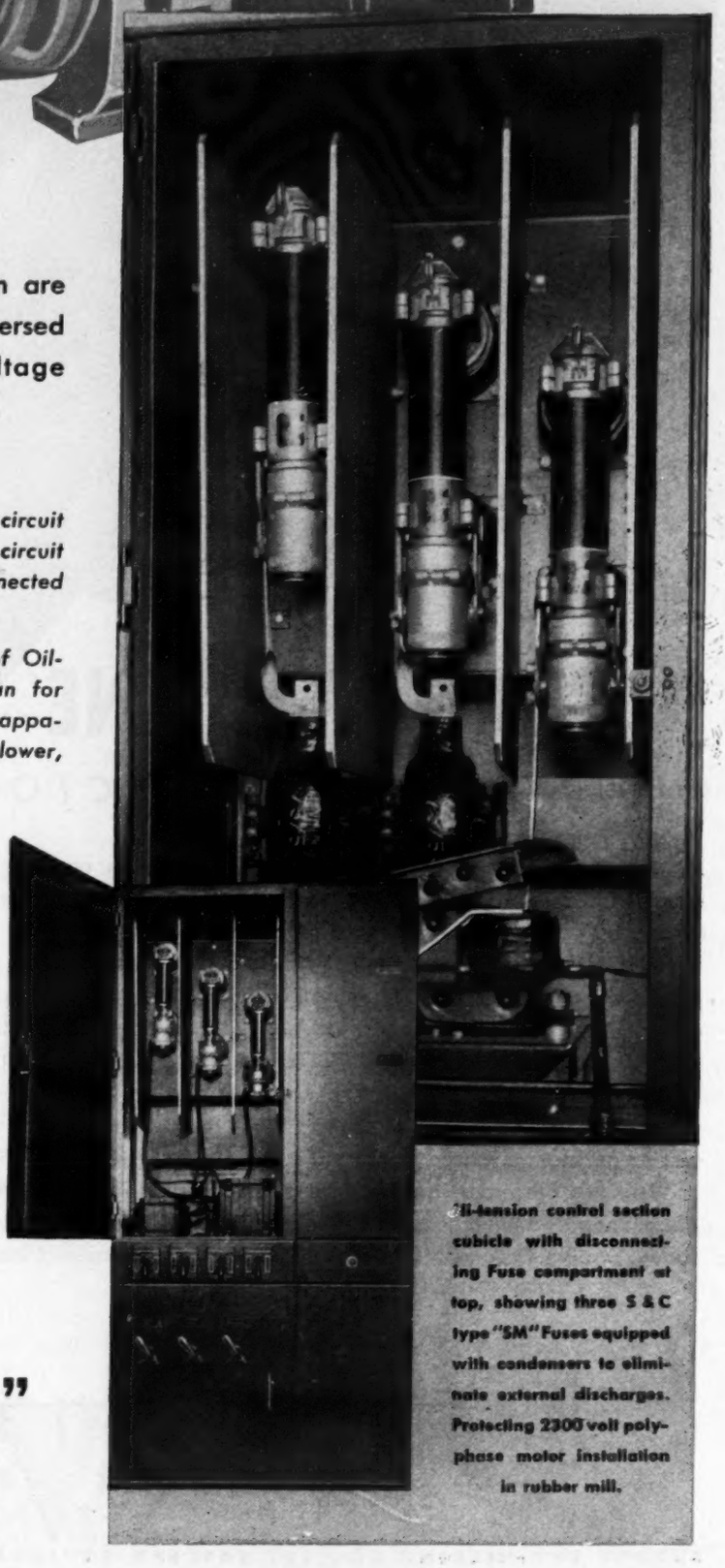
Type "SM" Fuse Refill Unit, for quick replacement on the job.

Type "SM" Fuses are available with ratings of 1- to 400 amperes, 2300/4000 Volts. Interrupting capacities up to 30,000 rms amperes or 207,000 kva.

For more complete data on Power Fuses for industrial installations, send for S&C Bulletins.

SCHWEITZER & CONRAD, Inc.
2435 Ravenswood Avenue, Chicago, Illinois
Manufactured in Canada by Powerlite Devices, Ltd., Toronto, Ont.

TYPE "SM" FUSES



High-tension control section cubicle with disconnecting Fuse compartment at top, showing three S & C type "SM" Fuses equipped with condensers to eliminate external discharges. Protecting 2300 volt polyphase motor installation in rubber mill.

BURNDY HYLINE

INDENT TYPE CONNECTORS

In sensitive electronic circuits, instrument networks, or power circuits, Burndy **HYLINE** Connectors provide connections that are *secure, efficient, low in cost,* and *workmanlike in appearance.*

HYLINE Connectors are formed from pure copper *in one piece,* providing compactness, high strength, and highest electrical efficiency. They are quickly and securely *indented* to the conductor with the compact Burndy **HYTOOL.** Or, where leads or harnesses are produced in quantity, they are indented on the high-speed Burndy **HYPRESS** . . . a bench press which attaches connectors as fast as an inexperienced operator can press a trigger.

Why not eliminate further circuit troubles and expense due to questionable connections, by substituting **HYLINE** connectors today. Simply state your problem and we will gladly submit samples.

Headquarters for connectors

Burndy

BURNDY ENGINEERING CO., 107 EASTERN BOULEVARD, NEW YORK 54, N. Y.

QUESTIONS AND ANSWERS ON CAPACITORS

OW WOULD YOU RATE ON QUESTION "B"?

every manufacturer—yourself included—has a list of questions grown at him regularly. We recently had our engineering partment compile a list of the questions that our engineers e most regularly called on to answer. You probably know the swers to most of these, yourself—but just as a refresher, erhaps you'd like to cast your eye down the list of questions d then see how right your answers are by comparing them ith the answers made by our engineering department.

A: QUESTION: What is the purpose of a capacitor installation?

ANSWER: To secure the benefits of improved power factor.

B: QUESTION: How is p.f. improved by the use of capacitors?

ANSWER: A capacitor placed in the line introduces a capacitive reactance which compensates partially or wholly for the inductive reactance in the circuit.

C: QUESTION: What are some of the operating advantages improved p.f.?

ANSWER: Improved starting characteristics, reduced voltage drop, a cooler system unburdened by wattless current and increased capacity for new machinery loads.

D: QUESTION: And the financial advantages?

ANSWER: Eliminates the need for re-wiring or adding more generating and station equipment. Saves penalty charges for low p.f. and excessive demand charges. Lowered operating current means cooler supply equipment and longer life. Avoids recurring shutdowns and idle man-hours due to blown fuses because of overloaded systems.

E: QUESTION: Can some lagging loads be corrected without resorting to capacitors?

ANSWER: Frequently. An underloaded induction motor, for example, will cause a marked lowering of power factor. Substitution of a smaller-sized motor of the proper rating usually corrects this condition.

F: QUESTION: What part of a system does the capacitor affect?

ANSWER: Only that part of the system between the installation and the power source. A capacitor installed at a motor would not change the power-factor of the motor—wattless current would still flow between it and the motor—but the rest of the system would not be burdened by unproductive current.

G: QUESTION: Are capacitors expensive?

ANSWER: Far from it. Power factor improvement via capacitors is the cheapest form of correction. Average costs installed are from $6.15 per kva to $13.00.

H: QUESTION: Where can I get more information on the use of capacitors?

ANSWER: Just drop us a line. Our engineers are always glad to be of assistance. Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

WORLD'S LARGEST MANUFACTURER OF CAPACITORS

Cornell Dubilier

capacitors *for power-factor improvement*

Whether for beaming a headline across the world or bringing it into your home, Federal is a leading manufacturer of radio transmitting and receiving tubes, including the giant tubes used by Mackay Radio in its world-wide Communications Service

In your morning paper
It's only an arrow
Creeping toward a dot on the map . . .

But out there
Where the angry earth
Convulses under your feet
From the thundering steamroller charge
It's hell on wheels
As the tanks attack at dawn

• • •

And close on their clawing heels
Spattered with the same mud and lead
As the mopping-up forces
Comes the soldier with the typewriter . . .
The war correspondent

• • •

When you read his eye-witness account
Of how this town was taken
Read between the lines
And give a thought
To the man under the helmet
Whose only command is . . .
Get the story!

• • •

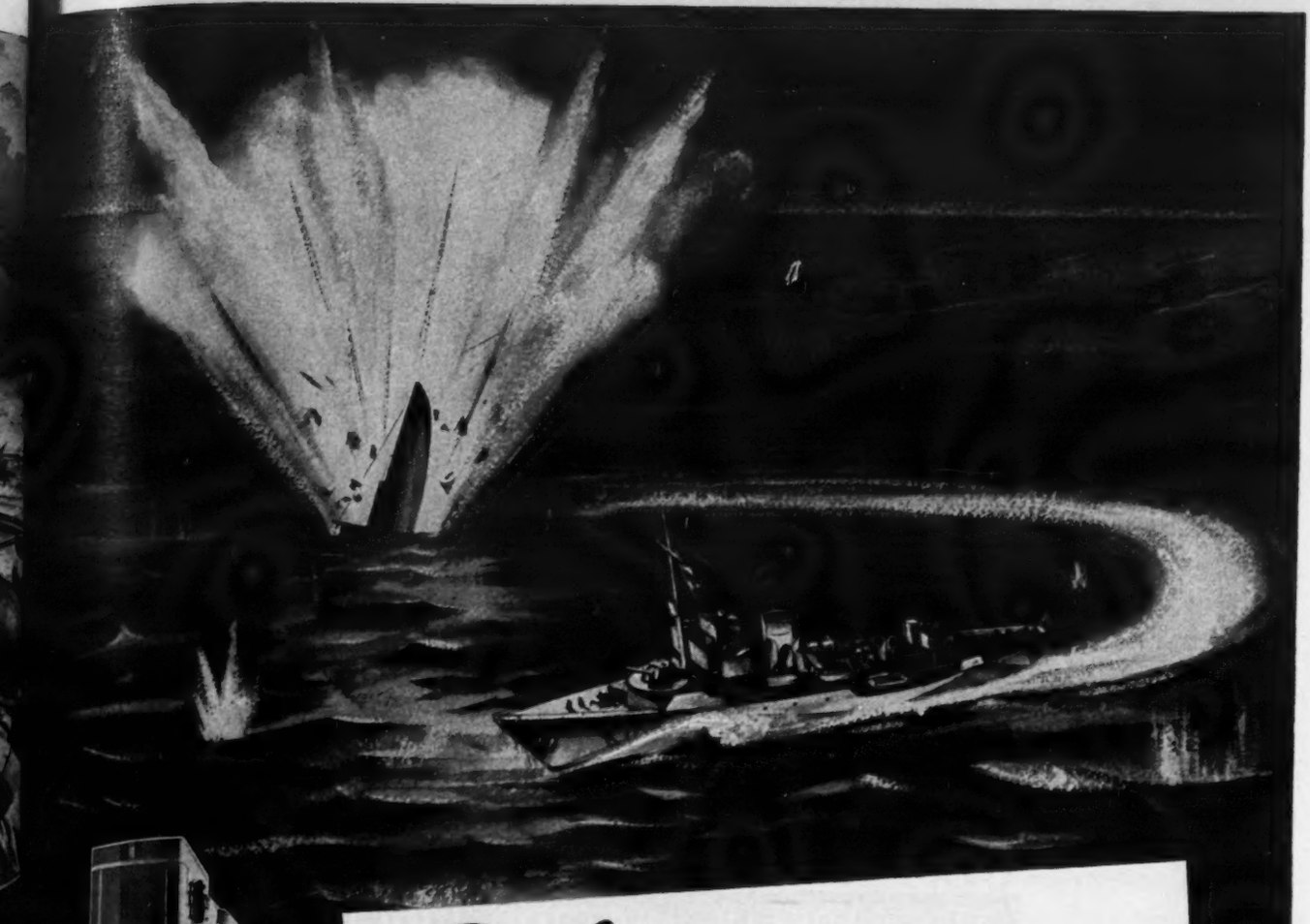
Helping him get the story *through*
Relaying it from field radio
To command outpost
To towering Mackay Radio
Trans-Atlantic radio telegraph station
Is the voice and ear of electronics
The vacuum tube . . .
Giving wings to his words
Just as it helps plane and tank
"Work together better
Because they can talk together"

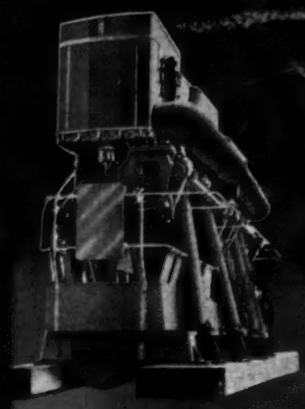
• • •

Here at I. T. & T.'s manufacturing associat
Federal Telephone and Radio Corporation
Where a great many of these tubes are ma
Our hats are off
To the men who use them
To speed victory . . .
Some day they'll help men
Build a better world

IT&T

INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION *67 Broad St., New York 5, N. Y.*
Manufacturing Associate:
FEDERAL TELEPHONE AND RADIO CORPORATION





Prelude to SAFETY OF THE SEAS..

This Jap sub had a "blind date" with one of the Navy's newest fighters but didn't know it until his inquiring periscope showed above the waves...then a quick pass...a terrific explosion...and there was one less sea marauder for the cargo ships to worry about.

That's the dramatic side of the war...the part that helps to inspire the entire Hendy organization to build the engines for these speedy escort craft...better and faster. There's a lot of drama too in building engines, especially when you are building for both fighting vessels and cargo ships. We like to think that every hour we save in the foundry, in the machine shop, or on the assembly line brings final victory that much closer...brings that day nearer when cargo ships will truly be the United States *Merchant* Marine, carrying peacetime products to every port in the world.

JOSHUA HENDY IRON WORKS

ESTABLISHED 1856

SUNNYVALE • CALIFORNIA

Divisions: POMONA PUMP COMPANY
CROCKER-WHEELER ELECTRIC MFG. CO.

Manufacturing Plants: SUNNYVALE, LONG BEACH, POMONA and TORRANCE in CALIFORNIA • AMPERE, N. J. • ST. LOUIS, MO.
Branch Offices: NEW YORK • WASHINGTON • PHILADELPHIA PITTSBURGH • CHICAGO • ST. LOUIS • SAN FRANCISCO • LOS ANGELES

THE CAREFUL INVESTOR JUDGES A SECURITY
BY THE HISTORY OF ITS PERFORMANCE

KERITE

IN OVER THREE-QUARTERS OF A
CENTURY OF CONTINUOUS PRODUCTION HAS
ESTABLISHED A RECORD OF PERFORMANCE
THAT IS UNEQUALLED IN THE HISTORY OF
INSULATED WIRES AND CABLES

THE KERITE INSULATED WIRE & CABLE COMPANY INC
NEW YORK CHICAGO SAN FRANCISCO

Meeting Production Schedules

The electric utility industry is meeting its production schedule. Losses in manpower caused by men entering the armed forces and by changes to better paid work have not reduced kilowatt-hour production. Nor has production been reduced by inability to continue long-established practices in planning, operation and maintenance of plants and systems. The electric utilities have had to revise their classic ideas of what is right and proper in loading equipment, have had to encroach upon previously inviolate margins of reserve capacities and strengths, have had in many instances to redefine their terms as regards quality of service. Despite these difficulties the production schedule is being met.

Perhaps the reason the schedule is being met is that there is no schedule; none, that is, in terms of projected quantities rigidly specified as to unit size, weight, constituents and quality. A kilowatt-hour is a kilowatt-hour—period. Being simply a measure of work done, it is always in the past tense. No one can say that a particular kilowatt-hour, or any number of them, out of a given lot is defective or does not come up to specifications.

But if it were possible to pick up and examine a kilowatt-hour before it is put into its assigned position in the scheme of war production, it is a safe bet that there would be investigators rigorously checking its dimensions and properties. There would be no admission of the obvious fact that performance is the only real criterion of quality and adequacy.

It is fortunate for the electric utilities that their product exists only when it has ceased to exist. The unit of production is a statement of performance accomplished and no pre-performance inspection of the product is possible. All that the utilities have to do, and it is a-plenty, is to see to it that the demand for kilowatt-hours is satisfied by the delivery of kilowatt-hours. That is the industry's production schedule; so far it has been, and in the foreseeable future it will be, amply met.

These thoughts arise from reading in the newspapers recent statements, interviews, opinions, exhortations and charges to the effect that industry is falling behind schedules of production of war materials. According to the temper of the man or interest giving voice, the knowledge or lack of knowledge of the subject, the purposes being forwarded or the prejudices being indulged, the blame for non-attainment of production goals is variously laid on industrial management, on politics, on labor, on almost any one or any thing.

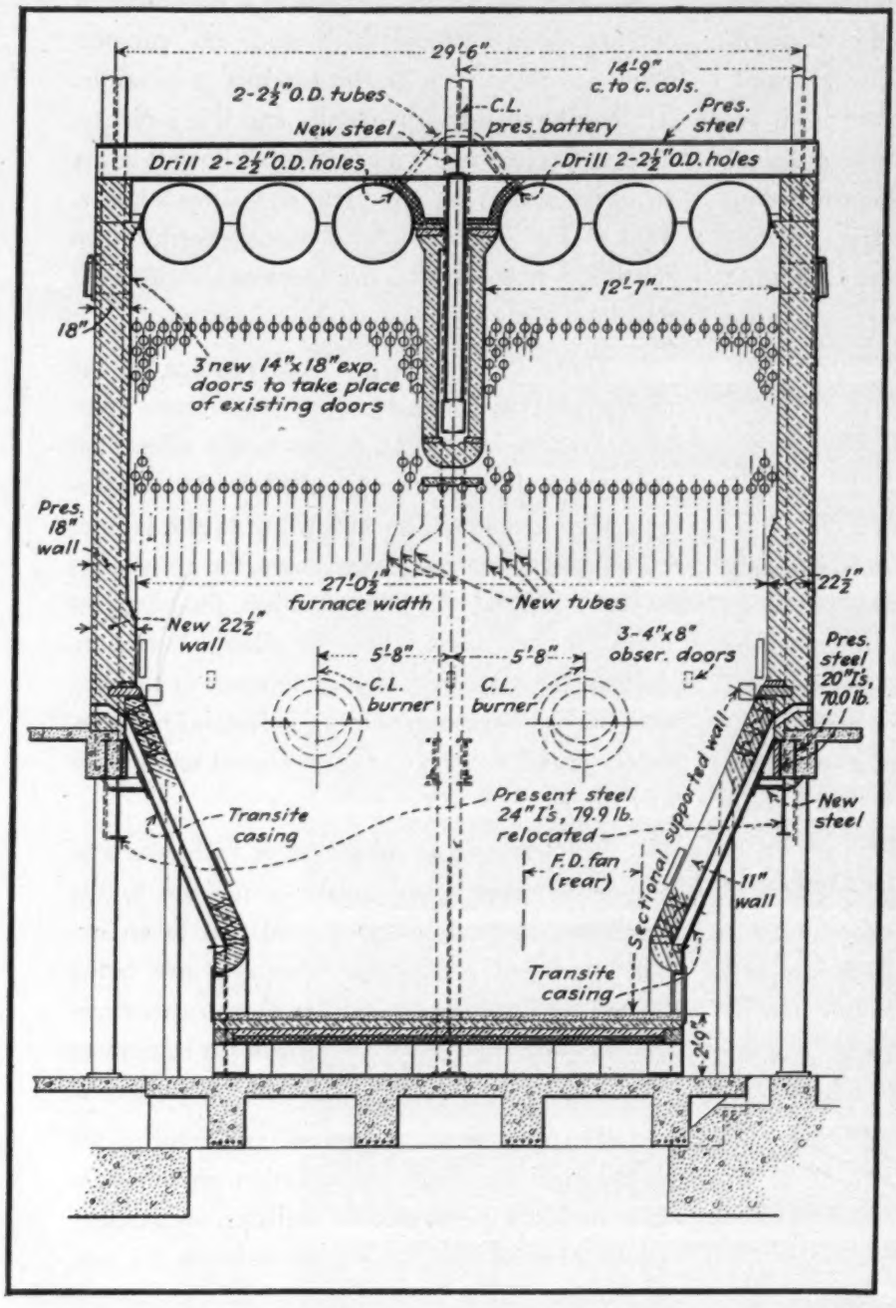
But whoever or whatever is to blame and no matter what other causes contribute to the condition, it must be recognized that to an important extent production schedules are being slowed by intransigent insistence on super-exact specifications that leave no margin for tolerances that in nowise hamper or harm performance.

The men who are harried and intimidated by that insistence must look rather enviously at their brothers in the electric utilities, an industry whose product can be judged only on its performance.

Problems of Conversion to Coal

Outline of the problems utility engineers are meeting in swinging from fuel oil to pulverized or stoker coal — Experience of typical companies

H. S. KNOWLTON, New England Editor, "Electrical World"



ARRANGEMENT of furnaces of two boilers when combined into single furnace unit for pulverized coal firing, Company A

REPRESENTATIVE electric utility steam plants in the East have been forced by fuel oil diversion for war purposes to change to coal firing at external and internal outlays ranging in typical cases from $225,000 to $550,000. Further conversions are in the offing. With usual foresight, utility managements have planned for conversion far enough ahead to insure the maintenance of full service to war industries and the general public. Pulverized coal has been utilized effectively in many installations, and stoker firing has also come to the front in conversion practice with good results.

Conversion Data

Where plants have been designed for the ultimate use of coal, with oil as a supplement or swing-back in case supply and economic conditions so indicate, the problem is simplified. In many instances, however, the change to coal calls for extensive additions to receiving, storage, reclamation, handling and preparation facilities at the plant site. Extensive changes in boiler settings, structures and fuel supply facilities within plants are frequently required. The retention for limited service of the former oil-burning equipment is often practiced, and in some cases facilitates operation at low loads and the handling of portions of fluctuating peaks.

Limitations of space, existence or nonexistence of water walls in furnaces, character of loads to be handled, quality of coal available and anticipated, superheating and draft conditions bear upon the conversion problem, as does the question of slag and ash control.

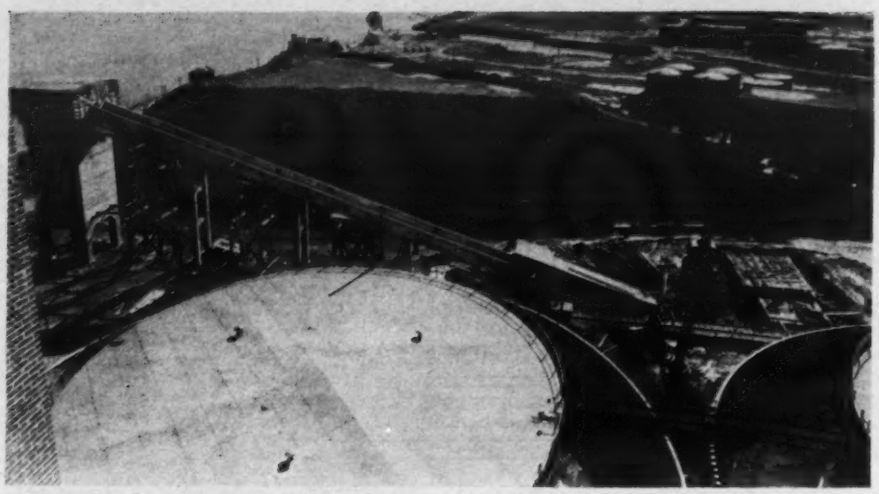
The manufacturer of coal-firing

quipment needs to know the following major data prior to quoting bids or conversion: Boiler make, type, ize, rating, layout of component parts, complete design of setting, surrounding conditions in the boiler house, adequacy of existing forced- and induced-draft fans, furnace design, steam pressure, feedwater temperature and superheat, steam required per hour, specifications of coal normally burned and of the worst coal expected, location available and power for auxiliary drives.

Slag and Fly Ash

Control of slagging and of fly ash are sometimes pressing problems in conversion to pulverized coal. The concensus appears to be that if heat release values are not allowed to exceed 24,000 to 28,000 B.t.u. per hour per cu.ft. of furnace volume with full water wall design, and reasonably clean operation of these surfaces, little trouble from slagging need be apprehended with coals at present available to Atlantic seaboard plants. With solid refractory walls the releases may have to run around 60 to 70 percent of these values to avoid slagging with ash fusing around 2,400 F. Coal with ash fusing between 2,900 and 2,400 F. calls for heat releases of the order of 8,500 to 18,000 B.t.u. Some engineers look with disfavor on pulverized coal burning unless water walls are provided, although exceptions may be found in practice. Soot blowers have been installed for use several times a day to keep the water walls clear on one notable Eastern plant. The dry bottom type of furnace is widely favored in Eastern utility plants on account of its simplicity and adequacy.

Fly ash associated with pulverized coal firing has caused excessive wear in induced-draft fans in a number of installations. Not a few plants have been designed to accommodate collecting and precipitation equipment to minimize this difficulty and improve control of the ultimate discharge of the products of combustion. Improvements in induced-draft fan design are afoot to facilitate the handling of fly ash and lengthen the period of fan service before renewal of parts on account of erosion. Collectors of multiple type, even if not available now, are expected to be at hand when the steel situation clears.



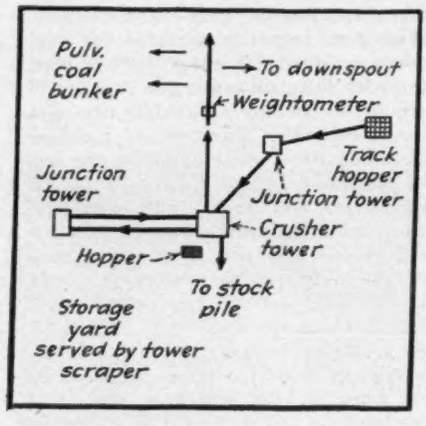
VIEW of new coal storage yard, conveyor belt incline under construction, and retained fuel oil tanks, Company B

Where a collector is provided, one manufacturer recommends that at least two additional inches of pressure drop be arranged for in the fan space. This authority calls for some form of collector wherever coal is burned in suspension.

Stoker Potentiality

Many engineers regard pulverized coal as flexible as fuel oil. The additional power required for preparation, considered from the B.t.u. angle, is not considered a handicap in view of the steam-heating requirements of fuel oil (say around 120 F.) in outdoor tanks subjected to cold weather.

Multiple retort stokers are being used on boilers delivering up to around 300,000 lb. of steam per hour, and traveling grate and spreader stokers up to about 200,000 lb. Some conversions of utility plants have found stokers an economical and satisfactory solution, and in certain boiler installations space conditions have been admirably met by this method of firing. It is believed that the use of stokers will increase in conversion practice, but the choice of firing methods is one requiring thorough engineering analysis in every case.



SCHEMATIC DIAGRAM, not to scale, of coal flow in yard of Company D, using Robins conveyor system

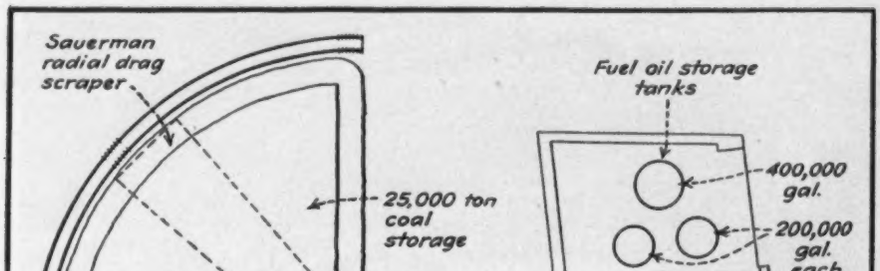
From these considerations it may be helpful to "high-spot" a few representative conversion cases taken from plants along the eastern seaboard:

Company A

This project involved conversion of four oil-fired furnaces under four 520-hp. boilers to a combination of oil and pulverized coal. Previously each battery of two boilers contained a parti-wall dividing the two furnaces. If no change had been made in the existing furnaces, the size of the furnace would have limited the capacities obtainable to an unsatisfactory degree. The furnaces were therefore rebuilt and the parti-wall removed. A suspended wall was hung between the tube banks of the two boilers and extended to a point about even with the third row of tubes. Four tubes were then bent outward so as partially to screen the under side of this wall. The volume contained in the original parti-wall thus became furnace space. The furnace bottom was carried to a lower level and the new settings combined each pair of boilers into a single unit.

The space between the two units is so narrow that had the width of the furnace at the bottom remained equal to the width at the top, ashes could not have been removed from the floor. Therefore the sides of the furnace were sloped to provide a greater distance between the units at the floor level. There are no water walls in these furnaces, but sufficient furnace volume was provided to develop 250 percent of rating when burning pulverized coal. Some revamping of the forced-draft system was required in this job.

Coal-handling machinery previously in-



GENERAL LAYOUT of coal-handling facilities for Company C

stalled to convey fuel from the yard hopper to the coal bunker was arranged to deliver coal to the pulverizers. This required the construction of a larger yard hopper, lengthening a belt conveyor feeding the hopper crusher, providing a motor drive, shaker pan and teeth for the crusher, and replacement of a large part of an existing flight conveyor located above the bunker. Two pulverizers were located under the existing bunker in an adjacent boiler room, which saved the cost of installing a new bunker and new coal-handling machinery, but called for four coal pipes, each about 110 ft. long, to carry the powdered coal from the pulverizers to the burners. A pneumatic system was installed to transport ash removed from the furnace to a new storage silo adjacent to one of the boiler room walls. Second-hand motors were used for the coal-handling machinery and second-hand steel where available. A used caterpillar tractor with bulldozer for storing and reclaiming coal was purchased, and in the supply of power to the pulverizer motors a metal-clad circuit breaker of the air-blast type was added to the 2,300-volt switchgear in the station. The approximate cost of this conversion was $225,000.

Company B

This utility operates two neighboring steam plants, one of which receives fuel by waterfront delivery, the other at present depending on rail handling, truck operation between the first and the second plant being feasible if necessary. The first plant has quite a variety of boiler equipment. There were 24 600-hp., 200-psi. boilers originally installed with underfeed stoker firing and later changed to oil by covering the stoker with fire brick and oil-firing these units through the bridge wall from the rear over the tops of the stokers. These have been reconverted to stoker firing with air duct changes at a total cost of about $1.000 per boiler. The plant also had eight oil-fired 600-hp. boilers operated at 200 psi., and the oil burners were removed and pulverized coal firing provided at about $1,200 per boiler. Finally, it contained four boilers rated each at 200,000 lb. per hour at 400 psi., built for oil or pulverized coal, and having refractory air-cooled front and water-cooled side walls, which have been available for powdered fuel operation.

The second station has three 300-psi. boilers with stoker firing and one 1,200-psi., 430,000-lb.-per-hour boiler designed for dual fuel. Here important additions to the fuel-handling and storage facilities were necessary when the large boiler was changed to a pulverized coal schedule of operation.

These two plants consumed about 10,000 bbl. of fuel oil per day when delivering about 131,000 kw. from oil, compared with an estimated use of about 2,000 tons of good quality bituminous coal per day under conversion and peak-load conditions.

The area originally available for coal storage provided for about 150,000 tons, but under complete conversion capacity to store in the vicinity of 250,000 tons was deemed desirable. This required purchase of additional real estate adjoining the second station, clearing, grading, laying of rail sidings and filling with coal. No permanent handling facilities for coal existed at the new site, so the work was rushed, using two bulldozers, a steam shovel, diesel tractor crane, four 35-ft. portable conveyors, four under-car loaders and a carryall scraper. A permanent unloading and conveying system for handling coal from cars to bunker is now being completed.

The use of powdered fuel was accompanied by some hardships due to wet coal prior to the installation of mill dryers. War conditions accentuated variations in coal characteristics. It was necessary to swing back to oil firing in portions of the plant during emergencies, under governmental approval. The company believes 50,000 bbl. of usable oil to be the minimum safe reserve.

Because handling equipment was not available to segregate the various coals, the clinker-forming properties of the ash from the mixture caused difficulties in both powdered coal and stoker-fired units. Reduced boiler efficiency and increased labor costs resulted, due in part to the frequent deslagging required and the additional maintenance work on furnace walls and stokers. Recently 21 Diamond Model I retractable soot blowers have been installed in the 430,000-lb.-per-hour, 1,200-psi. boiler, six in each side wall and nine in the rear, besides two Model IK telescopic blowers at the 36-in. drum line. These blowers have increased the make-up requirements, but have improved furnace conditions and virtually eliminated lancing. The furnace of this boiler is of the dry bottom type, with a volume of 21,500 cu.ft., lined with fin tube water walls and has six horizontal dual Combustion burners. Steam pressure at the superheater outlet is 1,225 psi. absolute and temperature 915 F. Three Raymond bowl mills supply the coal.

This station easily carried 50,000 kw. when burning oil, the bottleneck being feedwater, but with pulverized coal the bottleneck appears to be slag and the safe limit of output about 47,000 kw. The boiler efficiency has been well maintained and exceeds the 89.9 percent guarantee. Erosion of induced-draft fan equipment by fly ash has been a problem, reblading and relining being required after ten months. There is no precipitator and the cinder catcher equipment is limited. The two main plants of this utility delivered a somewhat lower output (about 22,000 kw.) under peak conditions after conversion, but this was due in large part to the number of old boilers involved in the transition. The estimated annual oil saving is 2,000,000 bbl.

Company C

This utility made a $250,000 investment in connection with a changeover from oil to pulverized coal. The plant has five 200-psi. Edgemoor boilers, originally stoker fired; one Riley boiler and one Combustion Engineering boiler, 750 psi. One of the Edgemoors had been converted to fuel oil to furnish 150-psi. industrial steam more economically over week-ends, the other four continuing on stoker firing. The company was in the process of installing the Combustion boiler, which had been designed for either oil or pulverized coal, but purchased for the former use, when a switch to coal became necessary. The Riley boiler was designed for either oil or coal burning, but had been running on oil. A comprehensive coal-handling system was immediately required to provide for the operation of the high-pressure boilers on pulverized coal.

This involved expansion of rail-receiving facilities with car pullers on one side of

the station property, with track hopper, crusher unit, storage, reclamation and handling equipment, including a 75-ton-per-hour Stephens-Adamson conveyor, with delivery to a bunker serving the new boiler equipment, from which downspouts carry the coal to the pulverizer units. A fly ash disposal system was also included, with silo for reception of ash by piping delivery from the new section of the boiler house, and the new coal conveyor was provided with a magnetic separator at a 90-deg. turn on the route from the crusher to the boiler plant. The former coal-handling facilities for the stoker-fired boilers were retained on the opposite side of the property, with elevator and conveyor mechanism serving these older units. At present a portion of the new coal field is occupied by stoker coal, but the layout enables this to be delivered to the 200-psi. boiler plant by the new conveyor when desired, although it directly serves the bunker feeding the high-pressure boilers.

Structural problems of importance were involved in extending the boiler house outward above a river, both for flood protection and the prevention of floating.

The new coal yard is equipped with a Sauerman radial drag scraper storage unit, with tail tower controlled from an operator's station above the track hopper. The scraper is a 2-cu.yd. Crescent bottomless outfit, handling about 1.5 tons of coal per trip. The initial pile was formed by chute from a Redler elevator tower. The tail tower runs on a quadrant track of 12-ft. gage, serving with the scraper an area with 25,000 tons storage capacity. Controls include a start-stop push button for a 75-hp., type KG, Tri-Clad squirrel-cage motor for the scraper hoist; lever stand for scraper hoist clutch control, and reversing drum controller with primary resistance for tail tower travel (15-hp. Westinghouse hoist type squirrel-cage gear motor). The tail tower is 15 ft. high, with about 153,000 lb. total weight, mainly in concrete. Propulsion energy is provided by a cable suspended between the tower and the operator's post. Three oil tanks of 800,000 gal. total capacity, with piping and handling facilities, remain on the property available at any time when a swingback to fuel oil becomes necessary. The steam capacity of the high-pressure boilers is 170,000 lb. per hour each.

Company D

This utility operates a steam plant including two 125,000-lb.-per-hour, 625-psi. boilers, designed for dual fuel service but recently converted to pulverized coal with the addition of extensive handling and storage facilities. Steam temperature is 725 F. Changes in baffles and a 50-deg. reduction in superheat were required, 14 tubes being removed for the latter object, in order to minimize slagging. Lancing doors were also installed in the boiler roofs and additional doors in the sides. Compressed air at 100 to 125 psi. has been found desirable for lancing because of cooler piping. A third B & W boiler was removed from the plant and sold to one of our Allies under Federal order. An adjoining mill property requires industrial

CONVEYOR BELT and dust exhauster system above bunker of Company D

steam, and this is supplied in part by three hand-fired, coal-burning, low-pressure boilers at 100 psi. located in another portion of the power plant.

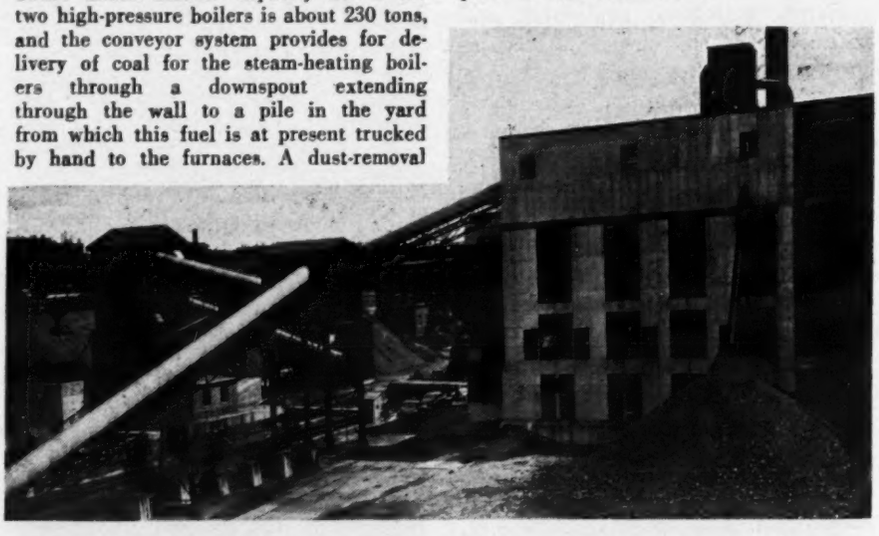
A Robins belt conveyor system (capacity 150 tons per hour) was installed in connection with the conversion, with track hopper, belts delivering to junction towers, a crusher house and yard stockpile of 25,000 tons capacity served by a drag scraper installation. Different grades of coal are used as it was found that the coal required by the pulverizers of the high-pressure plant was too fine to be fired properly by hand in the heating boilers, a lumpier grade being desirable for hand firing. The conveyor system was adapted to rather narrow space conditions between the steam plant and adjoining water courses, and provides the usual alternative between storage and direct delivery to bunkers. Coal cars are handled by an International tractor, and an 0.83 percent grade on the siding leading to the track hopper aids in car spotting. Eight 70-ton cars per day can be handled readily. The boiler house bunker capacity above the two high-pressure boilers is about 230 tons, and the conveyor system provides for delivery of coal for the steam-heating boilers through a downspout extending through the wall to a pile in the yard from which this fuel is at present trucked by hand to the furnaces. A dust-removal system has also been installed in the boiler house above the incoming conveyor. These improvements in connection with conversion cost about $600,000 and their completion gives the company a modern steam plant which can be operated with either oil or coal as circumstances dictate.

Company E

In this utility's plant conversion was made to spreader stoker firing (Combustion Engineering) this equipment being best adapted to the space requirements. Two 583-hp. boilers originally equipped with underfeed stoker firing had been converted to oil and have now been swung back to coal. The volume of the furnaces was increased about 80 percent by going down below the floor level. One extra man per shift is used in operation. There are no water walls. The plant is used in large measure as an auxiliary to a larger station. A cinder recovery installation was included in the conversion job. The layout is relatively simple and the cost favorable under the conditions. Operating efficiency will be about 78 percent, according to expectations. The existing coal-handling system of the plant sufficed to meet the conversion requirements, with minor additions. Each boiler is guaranteed to deliver 50,000 lb. of steam per hour and no slag troubles have as yet appeared.

Company F

This utility expended about $785,000, or $16.70 per hp., to convert about 47,000 hp. in boiler equipment to pulverized coal, retaining oil facilities in several converted stations. The saving in fuel oil will be about 20,000,000 gal. per year, or about 35 gal. of oil saved the first year per dollar expended in the conversion. Extensive additions to the fuel-handling and storage facilities were required, with fly ash control at some points, rail and waterborne coal handling, storage and reclamation, reduction of superheat for control, bunker construction, use of coal dust-handling equipment, and in precipitator equipment fortunately ordered for one installation prior to war restrictions.



COAL-HANDLING SYSTEM of Company D, with downspout from bunker house to supply industrial steam-heating coal to yard pile

Army and Civilian Utilities Pool Facilities for Emergencies

Under the "Utility Wartime Aid Program" private and publicly owned electric utilities contribute system maintenance facilities to the armed services to assist in emergency maintenance of the Army, Naval and Maritime establishments for the duration of the war

D. A. SULLIVAN,* Director, Utility Wartime Aid Program

ONE of the greatest construction jobs this country has undertaken has been completed by the Corps of Engineers of the United States Army. In a little over a year and in every state in the Union, Army engineers have built literally hundreds of soldier cities and military establishments, each containing all the modern utilities of a civilian city.

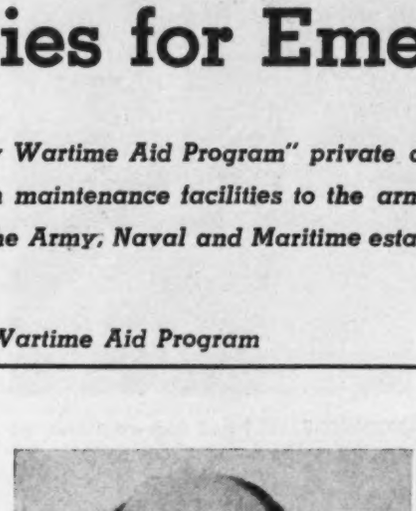
Now that the job is done, they have turned to the task of anticipating and providing for the many natural difficulties of maintaining these vast and scattered establishments. In this new job they face a scarcity of skilled labor, engineers and critical materials.

Navy Now Included

To meet these conditions with a minimum duplication of effort and use of critical materials, the War Department has enlisted the experience, research, materials, equipment and manpower of the electric utility industry under the voluntary "Utility Wartime Aid Program," which embraces private, federal and city electrical utility organizations.

The experience to date with the Utility Wartime Aid Program has been so uniformly excellent that naval shore stations and establishments of the Maritime Commission have been included under it.

In the event of emergencies, arising from storm, bombing or acts of sabotage, the plan contemplates that the equipment, men and materials of nearby utilities be mobilized and put at the disposal of the Army to restore service to vital military areas with a minimum of delay.



D. A. Sullivan

TYPICAL army camp distribution

Guided by the War Department through the Repairs and Utilities Branch, Construction Division, Office of the Chief of Engineers, and with the assistance of the War Production Board, several hundred operating electric utilities have voluntarily agreed to co-operate in this organized plan of maintenance for the war's duration.

Working Agreements

The program had its beginning in the Sixth Service Command, embracing Illinois, Wisconsin and Michigan, with headquarters in Chicago. The War Department, through the Corps of Engineers, at the outset was interested in learning what utility companies could offer in the way of normal and emergency maintenance facilities and what was necessary to make these facilities available to military posts.

To secure this information, the only practical method was for each supplier of power, working with post engineers at each establishment, to make a careful study and determine just what service could be rendered to assist in the normal and emergency operation of post electrical installations. Out of a series of round-table discussions held in the Sixth Service Command grew working agreements and plans for using available utility equipment, supplies and experience, since operating electric utilities must maintain sufficient force to take care of their normal maintenance, and be

* Engineer in employ of Commonwealth Edison Company, whose services have been loaned to the War Department as Power Consultant and Coordinating Director of Wartime Aid Program.

so organized that they can take care of all emergencies. Because of the scarcity of skilled labor and engineers, it has been the policy of the Corps of Engineers to maintain all facilities with a minimum number of civilian employees at all military establishments.

Utilizing the manpower and equipment of the utility companies for emergency service at government stations avoids the necessity of maintaining duplicate emergency crews and equipment. Also, utilizing the materials in stock of utilities likewise avoids the necessity of providing a large pool of idle critical materials in each area.

WARTIME AID SERVICES

1 Draw up plans in each service command that would enable the Army division engineer to mobilize quickly the necessary equipment, men and materials in the event of damage by storm, flood or enemy action.

2 Provide or loan transformers, switches, line materials, poles and miscellaneous supplies in the power companies' stock.

3 Loan line trucks, construction tools and hot-line equipment

4 Assist the maintenance crews of the stations with trained linemen or other employees whenever required. This service is frequently utilized for small construction jobs and is quickly available in event of emergency.

5 Give access to private telephone and dispatching lines to avoid overloading local telephone circuits in event of emergency and provide essential communication when local telephone lines are out of service.

6 Keep the post engineer staffs currently informed as to the availability of key men who should be contacted in the event of outage.

7 Provide where necessary facilities and personnel for routine or special tests of posts' equipment and supplies, such as relays, cable, circuit breakers, etc.

8 Furnish technical advice on the many problems which arise in the operation of substations, distribution facilities and utilization equipment of these "soldier cities."

9 Furnish engineering assistance in planning additions or changes in the post distribution systems.

10 Give assistance in developing blackout procedure.

11 Maintain through its representatives routine contacts with the post engineers' staff so as to be thoroughly familiar with the posts' problems, and to be readily available for consultation.

12 If possible, set up training program when necessary to assist armed forces in training electricians and high-tension men.

13 Repair failed transformers and other equipment at cost, contingent upon the post furnishing priority assistance to enable replacement of materials used in repair.

Co-ordination

As a result of the survey in the Sixth Service Command, the author was directed, by the War Department, to extend the plan throughout the country. In the interest of speed in the war effort, he was authorized to make all necessary arrangements, always working through the division offices of the Corps of Engineers located in each of the respective service commands.

In setting up the national program, however, it became obvious that certain companies centrally located in their area would have to act as co-ordinators to present the program to other utility companies in the area and, in company with their representatives, visit the Army establishments and present the program to the officers in charge. It will be noted from the following list of co-ordination that every section of the United States has been included in the program:

Boston Edison Company, Daniel Ricker.
Philadelphia Electric Company, S. H. Farace.
Carolina Power & Light Company, R. H. Reynolds.
Florida Power & Light Company, J. P. Carlin and C. H. Summers.
Georgia Power Company, Robert Edmond.
Alabama Power Company, R. M. Grogan.
Tennessee Valley Authority, E. J. Muir.
Utah Power & Light Company, L. W. Nims.
Northwestern Electric Company, E. F. Pearson.
Cincinnati Gas & Electric Company, Harry A. Bachler.
Union Electric Company of Missouri, E. A. Freund.
Texas Power & Light Company, Charles W. Wooldridge.
Commonwealth Edison Company, D. A. Sullivan.
Buffalo Niagara Electric Company, T. J. Brosnan.
Public Service Electric & Gas Company, N. J., George E. Dean.
Southern California Edison Company, C. E. Heath.
Pacific Gas & Electric Company, George E. Hunt.

Out of the hundreds of calls at military establishments made by these co-ordinators in the various service commands, working with local power company representatives and post engineers, it was found that the best interests of the War Department would be served if the power companies provided the services partially listed in the panel above.

Changes have been made in WPB priorities requirements to assist the functioning of the program as outlined. For example, as the program developed several power companies found it necessary to go through a routine similar to that required by P-46 with respect to "special sales" in order to lend materials to stations to meet urgent situations involving troop movements. This matter was taken up with the War Production Board, and until final adjustments were made WPB assumed full responsibility for technical violations where the need arose for loaning equipment.

This situation has since been corrected by provisions of the new "Utilities U-1" order, issued by the Office of War Utilities of WPB. Perhaps the most useful provisions of this order, in connection with the Utility Aid Program, is Section U-1-i, paragraphs 1 and 2 (vi) on page 4 of the order. This permits the free sale by a utility of any materials in its inventory for the repair of facilities of the Army, Navy or Maritime Commission or a public housing authority.

U-1 Covering Provisions

Any reluctance on the part of utilities to part with materials or equipment that they have in inventory for their own emergency use is overcome by the provisions of paragraph (f), (4), (iv) on page 3 of the order. For example: If a transformer in a substation serving an Army camp were to break down, and there should be no spare transformer available nearby to remedy the situation, except one in the utility's inventory, which transformer was being held for breakdown replacement, it could re-

lease such a transformer to the Army with the assurance that it could get a reasonably prompt delivery of a replacement transformer by using the rating of the order.

This far-sighted policy of the chief of engineers of the Army has resulted in the saving of much critical material and manpower. With the growing shortage of skilled electrical workers, such a program may in many instances be the only practical solution to the problems of the next few years. If properly developed to fit the needs of each military and naval establishment, it should prove of great value, since by these means the skill and experience of trained employees in the utility industry is made available in helping solve routine problems as well as provide assistance in emergencies.

Many Instances of Co-operation

Already the many years of operating experience and research of the nation's electric operating companies, as well as their equipment and materials, are being used with excellent results. Post engineers and division engineers in charge of the various service commands feel much more secure in regard to power failures than they did before the program started.

Many instances have already occurred that typify the splendid co-operation of the utilities participating in the program.

For example, the management of several utilities supplying power to very important military stations in the Middle West installed power lines and facilities in advance of the execution of power contracts when an urgent situation developed making necessary the establishing of important military stations immediately. The men and equipment involved worked 24 hours without rest, or until the job was completed. All the men who worked on these jobs had been with the companies for many years. Most of them were not subject to the draft and many were married with children in the service. They felt that by working at the station they were making a direct contribution to the war effort and it helped their morale.

Another illustration of the type of service rendered under the program occurred when a 100-mile wind disrupted all service at an important military establishment late one night. Prompt action by the power company restored service before daylight.

These and many similar incidents too numerous to mention testify to the spirit of willing co-operation and helpfulness that has contributed to make the Utility Wartime Aid Program a success.

To the splendid and patriotic co-operation of the electric companies throughout the United States who are co-operating in this program, and to the co-ordinating utilities who are contributing the time and expense of their engineers as co-ordinators in the various areas, belongs the credit for success of this undertaking.

The Corps of Engineers has well-organized operating and maintenance crews at all important military establishments, sufficient for all normal maintenance. With these, supplemented by the emergency crews, equipment, materials and many years of operating experience of the electric operating companies, emergencies are met promptly, and by pooling the industries' manpower and equipment with that of the armed services many thousands of dollars are being saved, and, more important, considerable highly skilled manpower and critical material can be diverted to other important war efforts.

Works Both Ways

It is recognized that the Army is one of the electrical industry's best customers, and in wartime perhaps its largest. Pooling the facilities of the electric utilities with those of the Corps of Engineers for emergency service will work both ways, for in the event of an operating emergency, caused by the elements or an act of war in any area, division engineers of the Army have offered the use of their available manpower and equipment to assist in restoration of service to any activity engaged in the national war effort.

A high official of the Army recently stated: "Co-ordinating the emergency standby services of all the utility companies with army post electrical systems has been so successful and complete that it will continue as a permanent relationship between the utility companies and the Army for many years to come."

• • •

Suggestion Plan Proves Valuable to Company and Employee Alike

Management and employees of the Pacific Gas & Electric Company feel well repaid for the efforts they have put forth in perfecting operation of the employee suggestion plan that has been in operation for the past nineteen years with this company. During this period more than 3,600 suggestions have been received. In 1942 there were 432 entries in the annual suggestion contest, indicating the wide employee interest that has been elicited.

The whole plan is operated by a research committee consisting of management officers and department heads under the chairmanship of W. G. Vincent, vice-president and executive engineer. All suggestions are promptly handled by the committee, and for those ideas found meritorious the suggestor is given a minimum cash award and made eligible to compete in the annual contest. Last year fourteen special awards were made in addition to three-prize winning awards. Monetary considerations ranged from $100 for the first prize to $10 for some of the special awards.

A recent feature of the plan has been the appointment of division suggestion committees in order to establish closer contact between the research committee and employees in the company's vast system throughout northern California. Suggestions may be made in connection with any of the company's activities. Included are: Construction, operation, maintenance, design, service, public relations, sales, accounting, automotive, tools, etc. Need for repairs cannot be made the subject for a suggestion. Executive, management, design and research personnel may not participate because it is their responsibility in part to develop new methods and equipment.

Damage Local and Less With Fault Bus Relaying

Alternative to conventional differential protection applied effectively to buses at generating station, 66-kv. outdoor substation and 12-kv. indoor metal inclosed gear

J. C. EPPLEY, Supervisor Electrical Engineering, Dayton Power & Light Company

FAULT BUS PROTECTION is designed to isolate a defective bus section from its sources of supply, and to do it before the fault current has time to get in its destructive work. There is probably nothing that a central station operator likes to contemplate less than the havoc which a bus fault may bring in its wake. Of course, fault bus protection of itself will not prevent a fault. That is dependent upon the design. Its value lies in getting the faulty section isolated quickly and restricting the damage to a minimum.

Highly effective relay schemes, which compare the current entering a bus section with that leaving it, have been developed. However, for the particular installations here described an alternative method has been employed. That is, to utilize the flow of fault current from the bus, through the bus structure, to earth, to initiate the opening of all circuits capable of supplying fault current to that particular section. Descriptions of installations on a 12-kv. generating station bus and on 66-kv. substation buses follow:

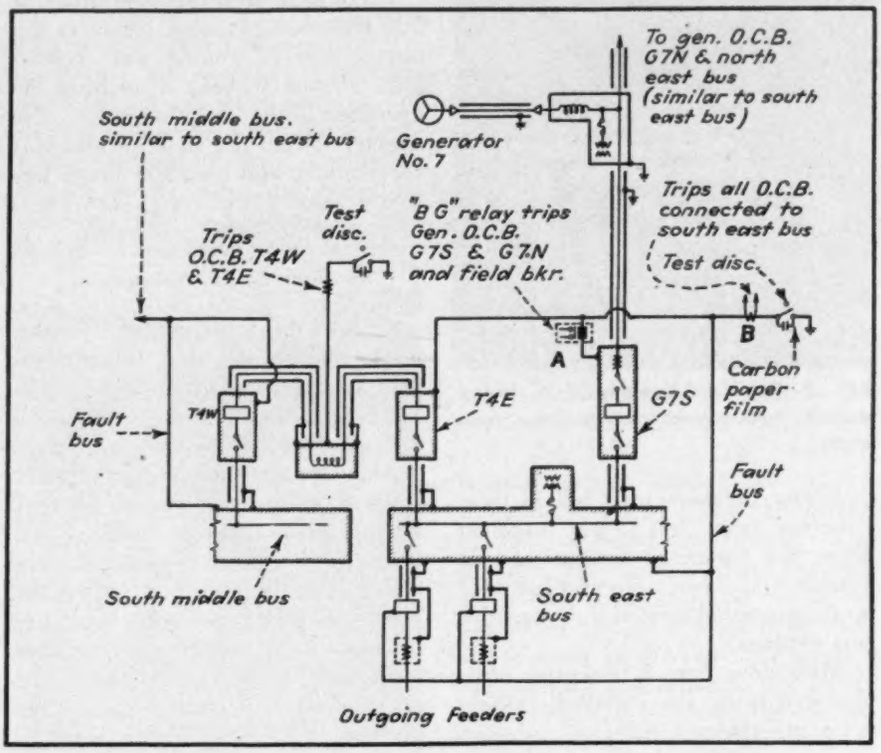


FIG. 1—Partial section of generating station fault-bus protection diagram

Station Fault Bus

The original station bus was contained in concrete cells with phases isolated by concrete walls. Generator, bus tie and feeder oil circuit breakers were also mounted in concrete structures. A decision to increase the voltage from 6,900 to 12,000, concurrently with the installation of additional generating capacity, afforded an opportunity for installing the fault bus protection. The concrete bus structures were replaced with metal structures. These structures were insulated from the building, and for each zone of protection (Fig. 1) one metallic path to earth was established. In this path was inserted a current transformer which actuates relays to trip all generator, bus tie and feeder breakers connected to that section. There are six bus sections, each of which requires a separate zone of protection. Each generator is connected to two bus sections, so generator breakers are each included in two zones. If a fault occurs in a generator breaker cell, that breaker and its mate on the opposite bus will be opened. But if the fault is on the bus, only the generator breaker connected to that bus is opened. The relay at "A" (Fig. 1) is faster than that connected to the current transformer at "B," so that a fault in the generator breaker cell will not take the entire bus out of service unless the fault is on the bus side of the generator breaker.

At the left side of the diagram there is shown the zone of protection for bus tie reactor and breaker compartments. It will be observed that armored cables have been included in protected zones, with the exception of those between generator terminals and generator breakers. These latter are covered by the generator differential protection.

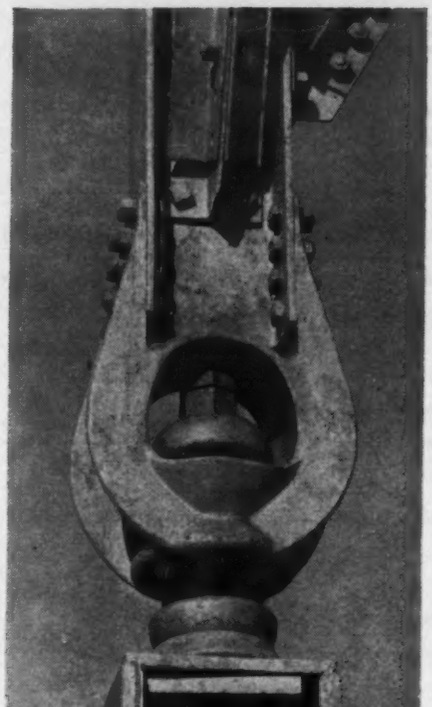


FIG. 2—Porcelain insulator 8 ft. above ground isolates substation columns from earth

Feeder breakers were left in their concrete cells, but were insulated from the concrete. Feeder current transformer bases were also included in the protected zone of the respective bus sections.

Meticulous care is essential when the structures are installed. Otherwise, maintenance men will consume hours searching for metal filings, poorly insulated anchor bolts, an iron conduit that has decided to make contact with the structure, or any of a host of other non-insulating things that conspire to nullify the fault bus protection. Each protected zone is tested each day (Fig. 3) with 110-volt a.c. During the test a piece of typewriter carbon paper is inserted in the path of the fault bus to earth. This gives sufficient insulation for testing, yet is sufficiently low to protect the man and permit the relaying to operate if occasion demands. After the early "bugs" are eliminated, it is rarely that the tests disclose other than the accepted path to earth.

There have been two operations of this fault bus. In both instances the bus section in trouble was successfully cleared without disturbing the operation of the five other buses. The damage due to the fault current was very minor, and certainly much less severe than would have been experienced without this protection.

Outdoor 66-Kv. Substations

Each of the outdoor 66-kv. substations consists of two independent steel structures, with incoming and outgoing circuits so distributed that either structure may be out of service and yet maintain continuity of service throughout the system. Where these circuit conditions did not exist, it was not considered justified to install fault bus protection. The steel structures were insulated from earth by inserting a porcelain insulator (Fig. 2) in each column, approximately 8 ft. above grade. The oil circuit breaker frames were set on porcelain. A porcelain section was inserted in operating rods of gang operated switches, and in each conduit containing control wires which came in contact with the structures included in the protected zone.

Connection from the insulated structure is carried through one current transformer to earth. As in the case of the 12-kv. structure, the fault current actuates relays which trip all breakers connected to the bus section in trouble. It is necessary to use relays having harmonic restraint on the 66-kv. substations to preclude operation other than on 60-cycle fault current. Such devices as potential transformers and power transformers are not included in the protected zone, since the conventional protection for this equipment serves to isolate it from the system. All line grounding switches are located on separate structures, which also support the 66-kv. lightning arresters, in order to keep them out of the protected zone. Where static wires over transmission lines were terminated on the switching structure, it was necessary to insulate them from the structure. Where possible, static wires were suspended from line tower to line tower above the terminal switching structure, and tied into the switching structure from line tower bases.

It would be a fitting climax to report successful operations of this protection, which has been applied to four 66-kv. substations. Fortunately there have been no occasions for its operation.

Metal-Inclosed Gear

Fault bus protection has also been applied to indoor 12-kv. metal-inclosed switchgear in these substations. To insulate the switchgear from the building a 4-in. depression was left in the floor slab under the switchgear. Two plies of asbestos roofing felt, mopped in hot asphalt, was applied to the slab. One-half-inch preformed asphalt expansion joints were placed along the edge of the depression. A concrete slab was then poured in the depression, upon which the switchgear was set. All conduits for power and control cables were, of course, non-metallic. Control cables do not have metallic sheaths. Bodies of 12-kv. cable terminals were insulated from the switchgear. The principles of electric operation are the same as previously described.

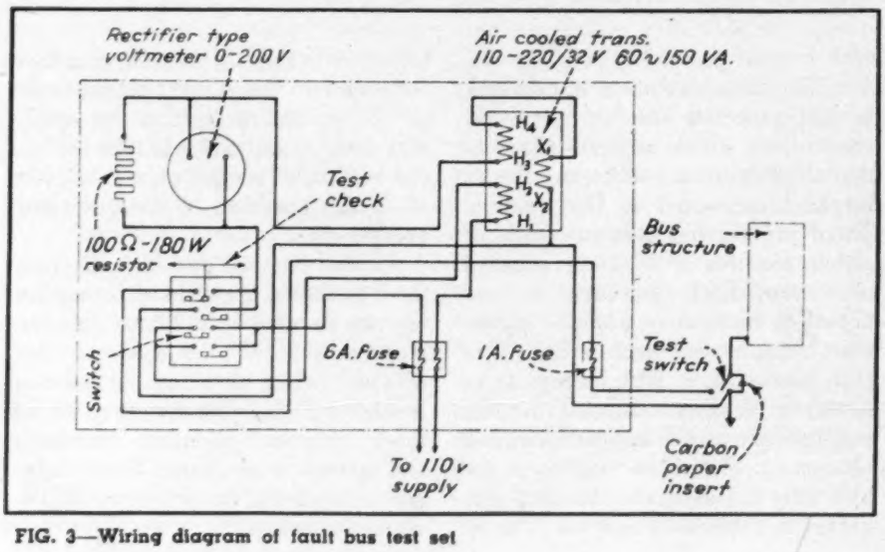


FIG. 3—Wiring diagram of fault bus test set

Resistors Watch Level in Water System Reservoir

Electronic rectifier and voltage regulator supply constant potential for automatic system by which reservoir level controls the operations of pumps

CARL E. NORMAN, Superintendent, Department of Public Utilities, Kalamazoo, Mich.

THAT the control system should "fail safe"; that is, in the event of the control circuit becoming short- or open-circuited, the controlled equipment should remain in its "as is" condition.

That no energy supply should be necessary at the unattended point of remote control.

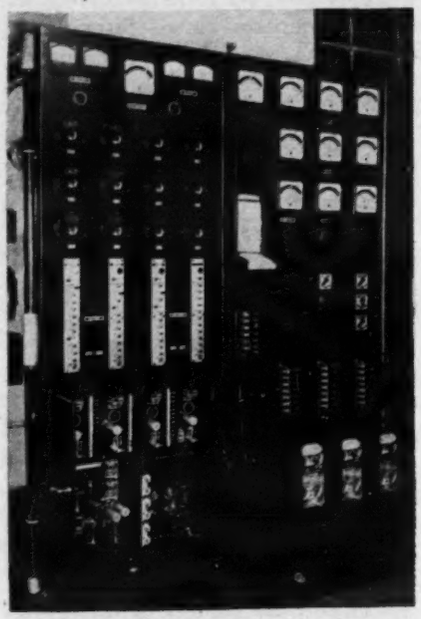
That control actuations should have sufficient time delay so that hesitant impulses from the remote point should not cause relays to chatter or to initiate momentary operations of the controlled equipment.

These were three requirements to be met in the design of a control scheme by which the level in a 7,000,000-gal. reservoir "floating" on the Kalamazoo water distribution system would start and stop equipment in the main pumping station 2½ miles distant. How well they were met is indicated by the fact that the system has now been in successful operation for about two years.

The reservoir is 20 ft. deep. Obviously, all pumps should be in operation when the water level is, say, half way down. Therefore the control system is designed to operate over the upper range of water level of 10 ft. Pumps controlled by the scheme, totaling 852 hp. of motors, are divided into three groups, any one of which can be preselected to start or stop at any 1-ft. stop of the 10-ft. range.

The control system elements are a constant voltage current supply and current-selective and other relays at the main pumping station, a pair of leased telephone wires to the reservoir and there a water level device of ten contact steps; all elements connected in series.

The water level device at the reservoir consists of ten mercury U-tubes, each with a single contact point. The points are set so that contacts are made and broken in the tubes in 1-ft. steps of level as the water in the reservoir rises and lowers. Each tube contact as it opens and closes respectively adds and subtracts a fixed amount of resistance to the series circuit, causing current increments or decrements of 3 ma., which actuate the current-selective relays in the main pumping station according to their settings and through them and associated devices control pump operation.



CONTROL PANEL in main pumping station

Constant voltage direct current for the control system is supplied by a Sola voltage-regulating transformer cascaded with a voltage regulating rectifier whose net effect is to hold the direct current at 107.5 to 108.5 volts for a range of 55 to 130 volts in the alternating-current input. For the range of ordinary commercial voltage regulation the change in direct-current potential is therefore extremely small.

Referring to the schematic diagram, in which the ten U-tubes at the reservoir are shown as one in order to simplify the drawing, relay No. 1 will pick up at a current of 5 ma., No. 2 at 8 ma., No. 3 at 11 and so on to No. 10, which operates on 32 ma., according to the amount of resistance cut into and out of the circuit by the contacts at the reservoir. If the reservoir should be full, the mercury column would connect all of the resistors in parallel and a current of 32 milliamperes would flow through the circuit, whereupon all ten of the selective relays would be picked up and their contacts opened. If the water in the reservoir recedes one foot, the connection to the uppermost resistor at the reservoir will be opened and the connections through the remaining resistors will cause a current of 29 milliamperes to flow through the telephone circuit. This will cause relay No. 10 to drop out and its contacts to close. In like manner, as the water recedes each successive foot one more relay will drop out and its contacts will close. The diagram shows the water level between elevations 239 and 240, in which case 23 milliamperes would be flowing through the circuit and relays Nos. 1 to 7 inclusive would be in the picked-up position, with their contacts open. Relays Nos. 8, 9 and 10 would be in the dropped-out position with their contacts closed. If the water in the reservoir continues to recede, so that the contact of the 8,370-ohm resistor at the reservoir is

opened, the current in the telephone circuit will be reduced from 23 milliamperes to 20 milliamperes and relay No. 7 will drop out, closing its contacts. By tracing the connections it can be seen that the closing of the contacts of relay No. 7 will start placing a charge across the 4,000-mf. capacitor. After this capacitor has received a sufficient charge, the associated time-delay relay will pick up. This will energize the transfer relay. While the contacts of the transfer relay are in motion, the time-delay relay receives its energy from the capacitor. As soon as the upper contacts of the transfer relay have closed, however, both the time-delay relay and its associated capacitor will be energized via the contacts of relay No. 8, which have already been closed some time previously. The transfer relay also operates the main relay, which in turn operates the motor-starting contactors.

Time-delay Averts Chattering

The function of the time-delay relay and its associated capacitor and resistor is to retard operations for a sufficient length of time so that imperfect contacts caused by the very slow changes in reservoir water level will not cause chattering of control devices or momentary operation of pumps.

If, now, we assume the water in the reservoir will rise to elevation 239 the current will again flow through the 8,370-ohm resistor at the reservoir and the current will again rise to 23 milliamperes, causing relay No. 7 to pick up and its contacts to open. Nothing will then happen, however, because the control of the pumps has already been taken away from relay No. 7 by the operation of transfer relay. When the water in the reservoir rises to elevation 240, however, a current of 26 milliamperes will flow through the telephone circuit, which will cause relay No. 8 at central pumping station to pick up, thus opening its contacts and removing a source of energy from the time-delay relay and its associated 4,000-mf. capacitor. After a time delay of a few seconds, during which the capacitor loses its charge, the time-delay relay will drop out and together with it the transfer relay, the main relay and the pump motors themselves. The transfer relay in dropping out places the time-delay relay under control of relay No. 7 again, whose contacts were opened some time previously.

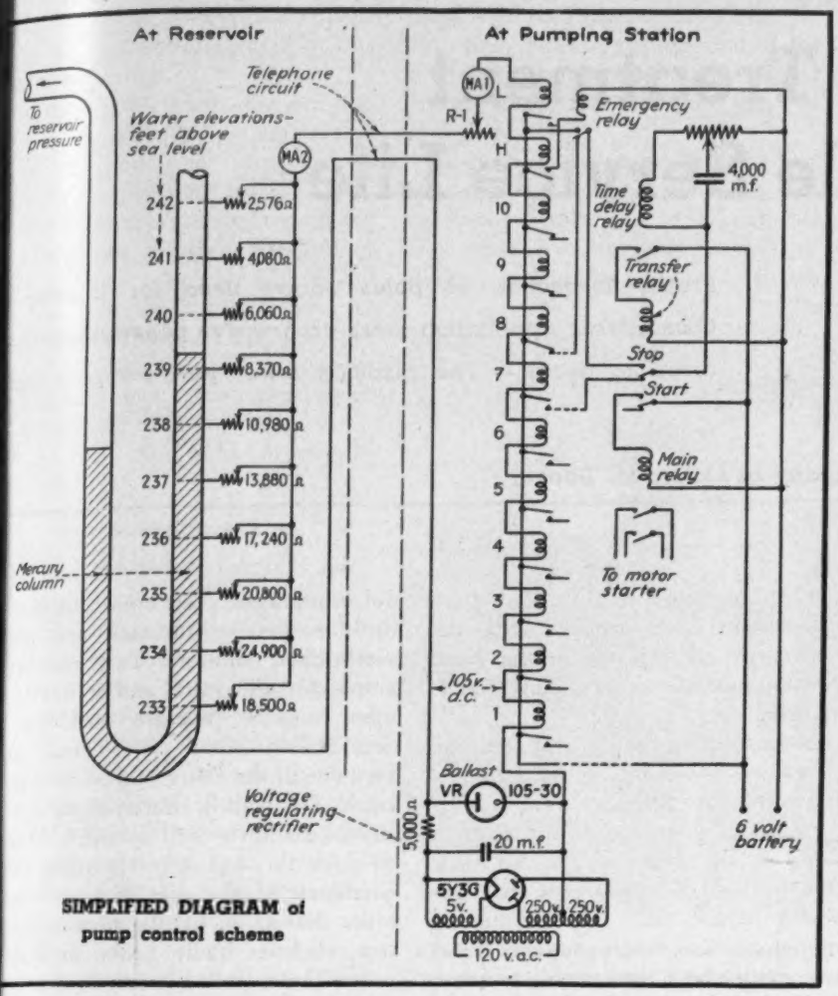
It can be seen that if the water level, in rising to elevation 240, should hesitate and the contact associated with the 6,060-ohm resistor at the reservoir should reopen before the 4,000-mf. capacitor has accumulated a sufficient charge, nothing will happen. If the 4,000-mf. capacitor has once received a sufficient charge, however, a momentary opening of the contact associated with the 6,060-ohm resistor at the reservoir will not cause anything to happen, because the capacitor will have accumulated a sufficient charge to carry it over such small periods of open circuit.

Besides the relays 1 to 10, inclusive, at the central pumping station, there are also two other relays identified by "H" and "L," these being also in series with the ten relays previously mentioned. In normal operation relay "H" is in the dropped-out position and its contacts open. This relay will not pick up until a current of 35 milliamperes flows through it. Conversely, relay "L" is normally in a picked-up position with its contacts open. It will not drop out unless the current through it recedes to 3 milliamperes or less. Thus, in normal operation, the contacts of both relays "L" and "H" are open and the emergency relay is de-energized. In case of an open circuit in the telephone line relay "L" will drop out and close its contacts. In case of a short circuit in the telephone line relay "H" will pick up and close its contacts. In either case the emergency relay is immediately energized. It can be seen by tracing the diagram that if this happens while the pumps are in operation (while the time-delay relay, transfer relay and main relay are all energized) the control of this group of pumps is taken away from relay No. 8 because the "stop" wire thereupon becomes energized directly from the battery, through the contacts of the emergency relay, by-passing the contacts of relay No. 8 or any similar relay. If, on the other hand, the time-delay relay, the transfer relay and the main relay all happen to be dropped out at the moment, nothing will happen by the operation of the emergency relay. Therefore, it can be seen that any pumps that happen to be in operation at the moment of the failure of the telephone circuit will remain in operation and any pumps that happened to be not in operation at that time will remain out. Upon the restoration of the telephone circuit to normal conditions the pumps will automatically be adjusted to the requirements as indicated by the water level in the reservoir.

The diagram shows control for only one group of pumps. Each of the three groups has its own time-delay, emergency, transfer and main relay paralleling those in the diagram. As the diagram shows one set of pumps arranged to operate between 239 and 240 ft. of reservoir level, so the other groups of pumps may be set to run between the same or any other levels. Actually, as appears in the picture, there are four sets of pump-control relays, one for use as a spare or for future additional capacity.

Start and Stop

While the diagram is drawn as if the "stop" and the "start" contacts of the transfer relay were connected directly to the contacts of relays Nos. 7 and 8, in the actual hook-up as used there is provided a set of ten telephone type switches and the "stop" wire is bridged to one terminal of each of these switches. The other terminals of these switches are connected respectively to the contacts of relays 1 to 10. Any one of these switches can be closed at will, connecting the "stop" wire to the contacts of any one of the ten current sensitive relays. In like manner, another set of ten single-pole switches is provided for the "start" wire, making it possible to connect the "start" wire to the contacts of any one of the ten current sensitive relays. As a matter of fact, the two sets of single-pole switches are actually one set of double-throw switches with their "start" positions on the left and their "stop" positions on the right. One set of such switches is provided for each group of pumps. These switches may be seen by referring to the picture of the control panel. Each of these switches is marked by a figure 233 to 242, inclusive, indicating the water level at which it is effective. By moving the handle of any one of these switches to the left, the water level at which that group of pumps will start has been selected, while by moving the handle of any one of these



SIMPLIFIED DIAGRAM of pump control scheme

witches to the right, the water level which that group of pumps will op has been selected.

Examination of the picture will reveal actually twelve small switches r each group of pumps. The eventh switch is a "hand-off-auto" witch. When this switch is in the hand" position its associate group of umps can be operated irrespective of ater level, while in "auto" position e pumps operate automatically acording to water level as described d while in "off" position that group pumps will not operate.

The twelfth switch of each group associated with a time switch. hen in the "on" position the "start" ire is cut in series with the contacts the time switch and then that roup of pumps cannot start until a redetermined time of day. This is ometimes used on week-ends and olidays. When in the "off" position e time switch is not effective.

At the central pumping station ere is provided a milliameter hav- a scale of from 3 to 35 milliamperes, the 0 being suppressed. Each three milliampere incremental step is marked in terms of water level, 233 to 242 ft. The space between two adjacent water level marks on the scale of the milliameter is about $\frac{3}{8}$ in. Theoretically, the pointer should always point exactly to one of the elevation marks on the scale. If the resistance, however, changes slightly, the pointer will drift away from its correct position. This amount of drift never amounts to more than about one-fifth of the space between adjacent foot marks on the scale over a period of a few weeks. The supervisor in charge of the system periodically observes the position of the hand on the milliameter, and if it has drifted away from the correct position, he merely adjusts the ballast resistor. These adjustments are necessary not more than about twice per month as seasonal temperature changes affect the resistance circuit.

After a power failure the pumps will restart without attention. It would be very undesirable, however, to both the electrical power supply system and particularly to the water system to throw the entire 852 horsepower of motors and pumps on at the same instant. The surges (both electrical and hydraulic) are sufficiently smoothed out, however, by starting the pumps of one of the three groups about three to six seconds after another group has started. This is accomplished by setting the rheostats associated with the time-delay circuits for the different groups at different positions. Thus one group may start one second, the second group four seconds and the third group eight seconds after the restoration of power, all accomplished by the capacitor-resistor values associated with the time-delay relays.

Equipment Details

While not shown in the diagram, the mercury of the "U" tube is not in actual electrical contact with the water. There is interposed between the water and the mercury a length of plastic tubing in which oil is contained, so that the mercury is actually insulated from the water and from ground.

Current sensitive relays 1 to 10 and "L" and "H" and the milliameters were furnished by the Weston Electrical Instrument Corporation. The time-delay relays were furnished by Struthers-Dunn, Inc. The transfer relays, main relays and emergency relays are standard telephone relays furnished by the Automatic Electric Company. The 4,000-mf. capacitors are of the electrolytic type and are mounted on standard radio-tube "octal" bases, making them readily removable for testing and checking. These and the resistors and rheostats were furnished by P. R. Mallory & Company, Inc.

The relays (except those shown on the front of the panel) and the capacitors are all mounted on sub-bases. Sub-bases having duplicate equipment mounted thereon are interchangeable one with another. Connections to the sub-bases are effected by miniature disconnecting switches, with the clips of the switches on the removable sub-base and the blades on the main stationary panel, so that in removing or resetting a sub-base it is not necessary to handle any wires. This form of mounting facilitates the removal of equipment.

Ground-line Treatment Prolongs Pole Service Life

Proper inspection of poles shows need for treating—Osmoplastic application gives progressive penetration, thus arresting decay — The result is lower per-year pole cost

PAUL B. HULL,* Public Service Company of Colorado, Denver

IN SEPTEMBER of 1940 we became actively interested in ground line treatment after a treating demonstration by a field engineer of the Osmose Wood Preserving Company. This interest was strengthened through correspondence with Eastern utilities whose successful experience with this ground-line treatment dates back to 1935. In October we purchased a small amount of material in order to determine for ourselves whether or not we would secure penetration of toxic ingredients in our wood species under our climatic conditions, comparable to penetration secured in the East.

Penetration of Preservative

In March, 1941, we removed one of the poles treated in November of 1940; in other words, the pole had been treated about five months.

Test showed that during five winter months penetration of sodium fluoride (recognized toxic wood preservative) had reached a depth of from ½ in. to 1 in. in the area to which the treatment was applied. The treatment also penetrated longitudinally along the pole above and below the area treated.

More than twenty months have elapsed since treating our first poles. In order to determine if penetration continued over a long period of time, we had a pole removed, disks cut, and tested. All decay had apparently been stopped by penetration of toxic preservatives (Fig. 1). Although twenty months is hardly long enough in which to draw definite conclusions, our results prove that we do secure penetration commensurate with the experience of utilities in the East, and the ingredients do inhibit fungus growth.

By inspecting the butts of standing poles by prodding or jamming a sharp bar into them we were making a mistake. When we started to treat poles in the field we realized what this method did to a butt that was sound before, since we are finding numerous cases where incipient decay can clearly be traced to this puncturing of the original creosote treatment zone and thus providing a perfect pocket for moisture and resulting decay.

An inspection program should be carried out by a crew employed to do that job and that job only. If the work is used merely as a "fill in" the chances are very good that the inspection will not be done or not be done thoroughly. Our crew consists of three men—one foreman and two semi-skilled laborers. Two men are ample for the work and it was for other reasons that we used three. Semi-skilled labor is sufficient; in fact, one of the men could be common labor. The man in charge of the crew should be fairly well versed in what we look for, not only regarding the condition of the pole, but also for other defects on the distribution system, such as badly gaffed or scaly poles, loops pulled loose, broken or split crossarms, etc., which if left uncorrected might adversely affect the safety of our employees or the public and continuity of service. It is very important that the earth be removed completely from around the pole being inspected, and to a depth of at least 15 in. (see tools in Fig. 3). Previously we had often inspected poles by merely digging down in two or

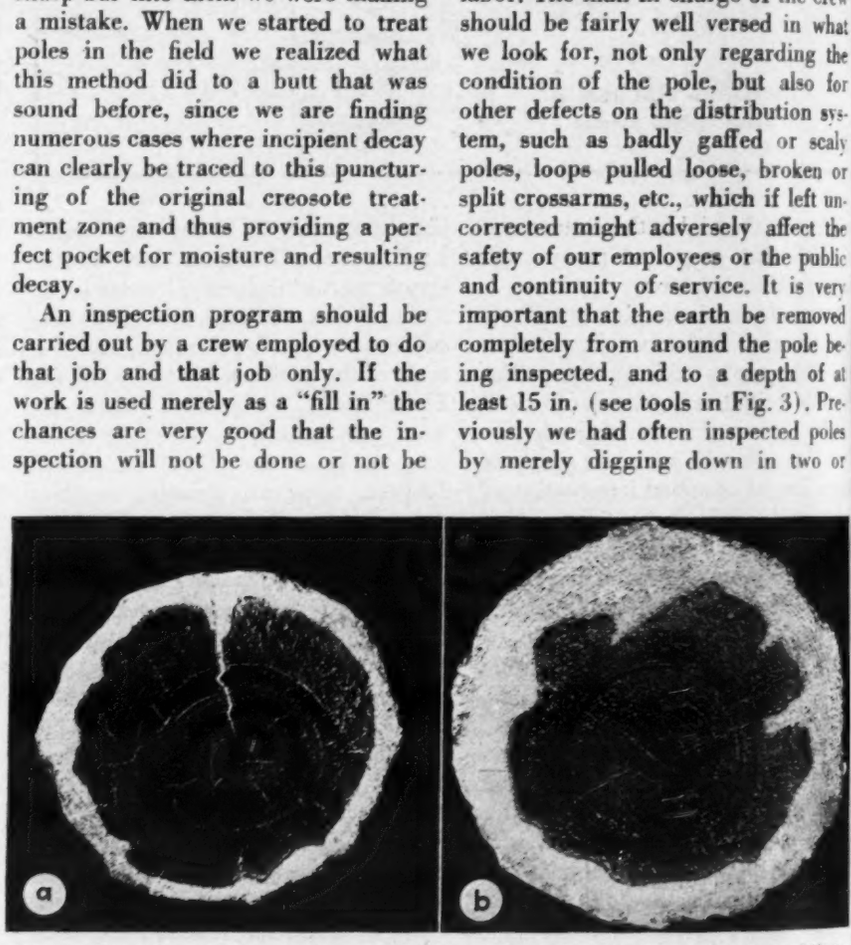


FIG. 1—Twenty-month penetration of Osmose toxic preservative in pole about 9½ in. in diameter at butt. (a) Disk cut 6 in. below ground line. (b) Disk cut 18 in. below ground line

* Assistant Superintendent Electric Distribution.

ree places around the pole. This is sufficient as decay might have gun in a spot not uncovered by this pe of inspection.

On these poles where the original reosote treatment is plainly visible ove the ground no inspection is ade and the poles are called O.K.

In order to record their findings the ew uses our regular distribution aps drawn to a scale of 100 to 250 r inch. On these maps they set wn the condition of the pole, the nount of decay found on those eated and their recommendations those found to be too far gone, as ell as line conditions previously entioned.

Treatment Procedure

If, after the dirt is removed from ound the pole, it is decided that ecay has not progressed sufficiently weaken it seriously and that the ole is otherwise worth treating, the ole is then enlarged to about 18 in. depth and with about 4 in. clearnce away from the pole at the botm. Decayed wood is then roughly moved and also overhanging sound ood where that type of decay is countered (Fig. 4). The Osmoplas Compound is then applied over an ea about 14 in. below and 8 in. ove the ground line. This area is en covered by a paper bandage, alays starting at the top, so that the rappings of paper tend to trap moisre, as it is mainly moisture that inres penetration of the preservative. he hole is then backfilled, the earth mped down and a metal tag bearing e word "Osmose" and the year is iled on about 7 ft. above the round. Removing of decayed wood es not have to be a perfect job; the ain idea is not to leave a lot of rotn wood to absorb the preservative d thus leave that much less for enance into the sound wood. Heating d thorough stirring of the comund in cold weather assists materially in securing uniform application d avoids considerable waste as the mpound, when cold, tends to roll f the pole and drop into the bottom f the hole.

On the poles to be replaced or ubbed, notes are given to our engiering department for them to work orders as in a good many cases ey might wish to put in higher les, reroute the line, etc. Emergens are, of course, taken care of without waiting for an order. Stubbing is employed in perhaps 50 percent of the cases, depending somewhat on the load to be carried, amount of transfer labor, objections to the stub of appearance, etc.

Inspection last year was carried on throughout the winter and with subzero temperature, but we feel that this is a mistake as not only the cost of digging around the pole due to frozen ground is increased, but the most important thing is that when the decayed wood is frozen solid it is extremely difficult to ascertain the true condition of the pole, either by prodding with a bar or sounding it.

We have not found the answer to inspection of poles in paving. Our present practice is to look at these poles and if evidence of decay is visible at the ground line we make a note of the location and when a sufficient number has accumulated we go back with a Barco gas hammer, breaking out the paving and proceeding with the regular inspection. If no decay is visible at the ground line we pass them up until such time as a cheaper or more practical method of inspection is developed.

Second-hand poles are constantly coming into the yard, having been removed for various reasons. We treat these much the same as those in the field, cutting off the decayed butt if it is too far gone, to make perhaps a 35-ft. pole out of a 40-ft. pole. We usually make the treatment zone about 6 in. longer than those in the field so as to be sure the treatment extends slightly above the ground line when the pole is set again. A coating is also applied to the sawed-off end to prevent possible decay from starting there. Poles badly gaffed or having bad checks may be cut up into stubs rather than treated as poles.

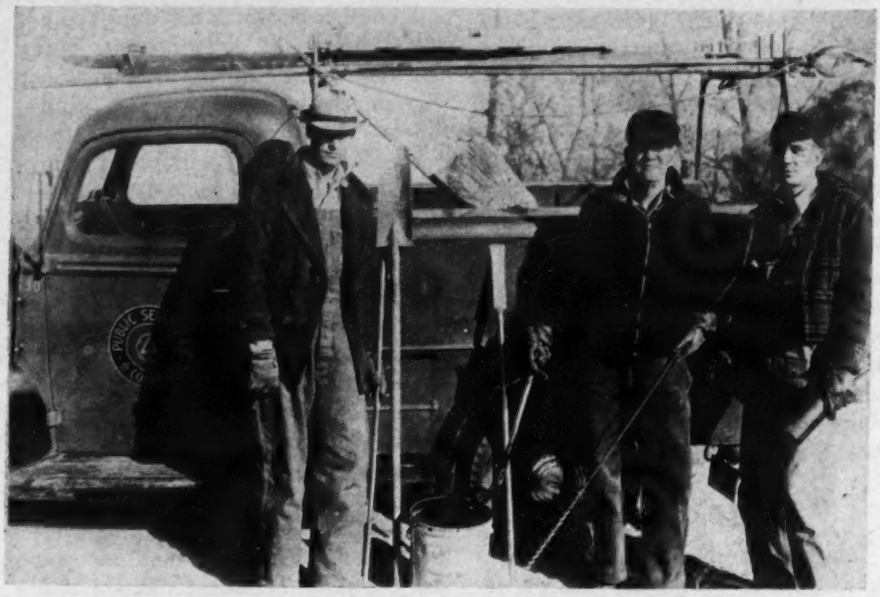


FIG. 3—Foreman and two men comprise an inspection and ground-line treatment crew. Tools include drain layer's spade, chisel bar (to chop off decayed and overhanging wood), small bars to probe depth of decayed spots, reel for handling paper bandage, heavy brush with long bent handle, long auger for taking borings, shovels, brooms, tamps and an increment borer

Prior to using the Osmose treatment we had our own plant for treating the butts of second-hand poles and stubs with creosote. This consisted of a large tank containing creosote. The poles were placed in an upright or standing position and the creosote heated to proper temperature. After the heating period the creosote was allowed to cool and poles or stubs were removed. The results obtained were rather erratic, and as the plant needed expensive repair and occupied much-needed space it was dismantled.

We believe that the Osmose treatment we are now giving second-hand poles and the creosote pressure treatment of stubs, subsequently described, provides better treatment and at much lower costs.

We stub many poles which have decayed at ground line to the extent of

rendering them unserviceable. These stubs are made in 12-ft. lengths from old poles brought into the yard, and which, after cutting the decayed butt, are too short or otherwise unsuitable for making standard poles. These stubs are then trucked to a local pressure creosoting plant located nearby, where they receive a full length creosote treatment. Because of the accessibility of this treating plant and resultant low cost, as well as our belief that creosote treatment properly done is superior to other methods of preserving wood, we do not treat any stubs in the yard with the Osmose treatment. It is noteworthy to state, however, that if a pressure-creosoting plant was not easily accessible and where freight haul would necessarily increase the cost, we would certainly consider using the Osmose method on stubs as well. These factors might also apply in mountainous districts in which the company operates, where stubs must be purchased new and local native timber is available.

Frequency of Inspection

We will completely cover our district again in four years and the results of that inspection will largely determine what our policy will be in the future. We think this four-year period will show the efficiency of the treatment in arresting decay and will also show whether decay has developed on those poles we inspected but did not treat. A period of eight years may then be safely allowed before the next inspection.

We estimate (on advice from other operating companies and from the manufacturer) that these treated poles will remain in *status quo*, in so far as decay is concerned, for eight to ten years; second, another benefit derived is the almost exact knowledge of the condition of our standing poles, which enables us to plan ahead for future work; third, still another benefit is the almost complete absence of poles blowing over in windstorms; during January we experienced several violent windstorms, but our trouble from this source was almost negligible; fourth, the items found wrong aside from the condition of the pole, and which have been mentioned before, are worth considering.

Cost Factor

Material cost alone is easy to determine, as one gallon of the compound will treat eight or nine poles of average size. Compound costs from $3.50 to $5 per gallon, depending on the quantity ordered, and this cost, plus about 10 cents per pole for the paper bandage, makes a total material cost per pole of about 60 cents.

This also holds good for any saving effected. No doubt it would be possible to work out some long-winded mathematical dissertation as to the amount of theoretical saving possible, but the benefits are so apparent, in view of the low cost, that this seems hardly necessary.

We have had our program of inspection and treating in operation for about 20 months. It has enabled us to save a considerable percentage of poles on which decay had started, but still have sufficient strength for service. It has also brought to our attention the poles which had been rendered unserviceable. Today we know the true condition of our pole plant and we believe that our continued inspection and treating program will enable us to check decay before it reduces poles below their required strength, thereby avoiding costly replacements. This will reflect favorably in our per year pole cost:

		Percent of Total
Poles marked "OK" (treating line visible)	11,330	35.5
Poles marked "Inspected" (no decay found)	16,914	53.1
Poles marked "Treated" (in the field only)	1,389	4.3
Poles marked "Replaced" (stubbed or replaced)	2,267	7.1
Total poles inspected	31,900	100.0

It is possible that the ratio of "treated" to "replaced" is somewhat out of line due to the inspectors not wishing to assume the responsibility of saying that a pole was safe when considerable decay was found. Periodic checking, however, of the replaced poles as they come into the yard indicates that there is nothing radically wrong with their judgment.

Probably 95 percent of our standing poles and those being bought new are creosote butt-treated Western red cedar.

1. Hole is made 18 in. deep, with 4-in. clearance at bottom.
2. Decayed wood around pocket is removed (a).
3. Compound applied to 14 in. below and 8 in. above ground line (b).
4. Paper wrapped on, starting at top, to trap moisture and prevent absorption of toxic preservative into soil (c).
5. Hole back-filled (d).

FIG. 4—Steps in applying Osmoplastic treatment.

PRIORITIES PROBLEMS

Design Standards for Switchgear, Insulators

An increasing part of the duties of WPB divisions and other operating units is the further conservation of materials through simplification, standardization, promulgation of rigid design specifications and removal of superfluous parts from necessary equipment.

First WPB job was the halting of unnecessary production, not only to save materials but to release manpower and facilities for war work. This was the era which saw production of automobiles, electric appliances and similar consumer durable goods halted. Now the emphasis is on making all possible savings in those products which must be produced to carry on the war.

Two new schedules added to Order L-154 recently (ELECTRICAL WORLD, July 3, 1943, page 15) are outstanding examples of the philosophy of this latter type of conservation. Order L-154, issued in June, 1942, authorizes the establishment, by means of schedules, of specifications and restrictions covering production of power equipment which specify allowable design and manufacturing processes. The two new schedules are 4, covering power switchgear, and 5, high-voltage insulators.

Elimination of Items

OWU's Switchgear Section, which drew up the schedules, had three main points in mind when it set out to reap what savings were available in the manufacture of these items. The first step was to eliminate as many sizes, styles or models as possible and reduce the line to the minimum number of sizes needed to handle ordinary conditions. Second step was to eliminate from production all unnecessary or duplicate complete items. The third step was to trim to the bone the allowable materials in those items which remained.

The first step of eliminating unnecessary sizes, types and models was used most drastically in Schedule 5, where the allowable sizes of insulators were sharply reduced. The allowable number of cap and pin type suspension insulators was reduced from 44 to eight, for example. In Schedule 4, disconnecting switches and cutouts were confined to a minimum number.

Five sizes of inclosed cutouts may be made and six types of open cutouts. Fuse links are limited to two designs, and two types of mounting brackets may be made for open and two more for inclosed cutouts.

In eliminating duplicate and unnecessary items, OWU ruled out double and duplicate buses, spare panels and fillers, all panels for control of future equipment or for future feeders and instruments on panels where readings are not necessary. All this was "gold plate," standard practice during the days when there was no pressure on materials and manpower. But the equipment from which it has been ordered removed will function just as effectively without it, and as a result, the "gold plate" goes until such time as it can profitably be restored.

To accomplish the third step, that of trimming to a minimum the amount of materials used, OWU not only banned certain "plushy" design practices outright, but also lowered the quantities of that material which could be used. Much substitution was ordered, such as iron and steel for copper wherever practicable, substitute for structural steel in substation structures, ferrous for non-ferrous hardware and fittings, transite or treated plywood rather than steel for barriers, palnuts or shakeproof washers for lock nuts and washers. Where air-break switches or fuses will do the job, oil or air circuit breakers may not be used. Power switchgear must be designed to operate on a temperature rise basis rather than the traditional, and more extravagant, amperes per square inch basis. In specifying switchgear, builders may not use equipment with a voltage rating higher than the next available standard voltage rating beyond the voltage at which the equipment is to operate. Steel barriers have been omitted or reduced in gage. Steel frames and braces must be of the minimum size which will do the job. Small switchboard wiring is reduced from No. 12 A.W.G. to No. 14 A.W.G.

Based on present production rate, it is estimated these two schedules will save more than 3,000 tons of carbon steel, 200 tons of alloy steel and more than 2,000,000 lb. of copper yearly.

Reworking Copper Wire Helps Utilities

Today, OWU figures show, about 20 percent of the wire used for construction is made from new copper allotted to OWU by the War Production Board. About 60 percent of the copper conductor used for construction is obtained from excess inventory and used "as is" and the remaining 20 percent is obtained from excess inventory and reworked, with the premium price paid by the utility.

Utilities which pay these premiums are helping out the entire industry, in that this copper constitutes an addition to the amount of copper available to the electric utilities for all approved uses in any given quarter.

This practice is helpful to the industry in another, less apparent manner. As has been noted, any excess inventory may be used without encroachment on the quarterly allotment under CMP. However, if excess conductor which might be redrawn be scrapped, it passes out of OWU's jurisdiction and is added to the pool of copper whence all demands are supplied. The pool is allocated by WPB's Requirements Committee. While a huge scrapping program by utilities might increase the pool sufficiently to increase OWU's quarterly allotment, utilities would be putting in much more material as scrap than they would be taking out as new material in the form of a larger OWU allotment. Utilities will get back in increased quarterly allotments to OWU only a small portion of the metal they scrap, because there are nearly 20 claimant agencies, all of which will demand a share of any increase in available materials which results from scrapping efforts of any one industry.

Editorials

S. B. WILLIAMS, *Editor*

Preparation for an Emergency That May Never Arise

FIFTEEN MONTHS AGO, when L-94 was issued, it was expected by the power branch of WPB that the order would be invoked in some areas by midsummer of last year. No such action, however, has had to be taken, nor from the standpoint of capacity and foreseeable load is any looked for at this time.

Nevertheless, there is always the possibility that something may happen that would make the invocation of L-94 a necessity. Are the utilities as well prepared to reduce service in such an emergency as they have been to supply increased service during the war?

Any mandatory rationing under L-94 is a function of the Office of War Utilities, but if an emergency should occur it might be of the sudden kind which would leave the local supply situation somewhat chaotic if no advance preparations were made.

Naturally no company wants to tell customers that in the event of emergency they will be the first to be cut off, but this is a case of the greatest good to the greatest number, or the greatest cause. If lists could be prepared by all utilities, as some have already done, showing what loads could be quickly dropped in case of an emergency, and the customers were warned, any unusual trouble could be handled with the least inconvenience to the load as a whole. And if the difficulty were to be of several days duration or longer, OWU could stabilize the situation much more quickly by having such lists available.

There is nothing to indicate that the necessity for enforcing L-94 will arise during the war, but if it should such advanced preparation would be most helpful.

Coal Control Points Up Conservation Program

GRANTING for the sake of argument—and for that alone because we do not believe it for a minute—that some electric utility men may have had their tongues in their cheeks when they subscribed to the electricity conservation program planned to begin next month, then any such tongues must now return to normal position.

The cause of the lingual shift is the current report that preference ratings for coal are about to be set up by the Solid Fuels Administrator. Priority No. 1 will be given to coke making; that is, steel production. Electric and gas utilities come under the second rating. The plan is to put utilities on a footing of one month's supply on hand and deliveries will be controlled in order to attain that result.

According to Department of Interior statistics, electric utilities had a national average of 94 days' supply of coal on July 1. A month earlier the supply was sufficient for 113 days, and it had been enough for 100 days or more since September, 1942. In the two years back from this summer the utilities have averaged well above two months' supply on hand.

With the seasonal rise in the annual load curve now approaching, and with deliveries curtailed, it will not take very long for coal stocks to shrink and to give operating men, accustomed to looking at full storage yards, a real appreciation of the virtue of the electricity conservation program.

The Bloodless Revolution in Rubber Insulation

"BLOODLESS REVOLUTION" is a phrase that pretty well typifies what is on the point of happening to wire and cable insulation that has to have properties that only rubber could offer in terms of cost, availability and performance. The buyer, applier and user will hardly know it is happening, but within six months there will be precious little crude rubber going into the insulation of conductors for civilian use—it will be practically a 100 percent synthetic product. Rubber Director Jeffers said recently that synthetic rubber is here to stay and can hold its fort against crude rubber from vegetal origin. This, he promises, can be done without dependence on protective tariffs or subsidies. And besides, the post-war cost will be about where natural rubber stood in pre-war normalcy.

Some weaknesses of synthetic rubber show up when tried out for truck tires, but there is no indication that that difference means anything to electrical uses. The user of synthetically insulated and jacketed conductors will hardly be conscious of a change. There is no perceptible difference in texture, size, bending, pulling, splicing, nor in the general promise of performance. Voltage tests will be the same, but, for the duration of the war, will be of shorter application-time. Insulation resistance (current leakage) may differ from crude rubber products, but this is not an invariably critical factor. Aging and resistance to the effects of oil and ozone are said to be better in the synthetics than natural rubber.

This is definitely a case in which man has mimicked the result of nature's processes to a high degree of similitude. The chemical engineering array of pipes and valves and huge process vessels, along with the high tempera-

res and pressures, have no resemblance to the root d fibre structure of the ule tree or the guayule shrub. y drastically different and distinctive man-methods the sult is so close in composition and reaction to these ms and saps of the tropics as to be mystifying to all t the polymerizing chemists. Down from petroleum or hyl alcohol comes the butane and butadiene which mbine (to form the butyls and bunas of synthetic bber) with the styrene that descends from a coal bar cestry by way of benzene and ethyl benzene.

Time only will tell whether these artificial rubbers ill be controlled in process with such nicety as to insure stained performance equal to processed crude rubber. lasticizers, pigments, fillers, degree of polymerization e all variables in the synthetic picture which can ual the variations logically expected of the rubber that ture makes and man has collected here and there over e tropics. But for the present era the transition proms to entail practically no worries or headaches for the er.

When the Lights Went n Again in Harlem

F ANY MORE PROOF is needed of the police power of ght, here it is.

The hoodlum element broke loose in New York City's arlem district on the night of August 1. Growing in boldss through months of comparative immunity afforded y the dark shadows of the dimout, the lawless spirit shed out in rioting in which lives were lost, many people njured and much property damaged. The police and hers attempting to prevent personal attacks, looting and alicious destruction were seriously disadvantaged by e fact that they could not see, and evil took strength nd effrontery from the darkness.

But the next night the district was quiet. During the ay permission to light up the streets had been obtained om the Army. For Harlem the dimout was lifted. Not nly the street lights, but hastily installed flood and earchlights threw back the night. Without shadows in hich to lurk, from which to spring, the hoodlums disppeared from the streets and honest men could walk broad again.

Cutting Industry's Wages

RENEGOTIATION is a new two-dollar word for an old nd long-condemned practice. It used to be called piecework-wage cutting. It has done more to reduce efficiency f production than any other mistake management ever nade. The pieceworker received a contract at so much er piece. He went ahead on the idea that he would get hat much for all the pieces he made. Then as his skill aised his earnings beyond a certain point, management ut the price. Labor took the obvious course and limited output, so that in 99.9 percent of all factories in the United States limitation of output is a fixed policy, disobedience to which results in a cracked head for the man who goes above the established limit.

The thoughts above expressed are those of J. F. Lincoln, electrical manufacturer. They are advanced by him in support of his thesis that manufacturers of standard commercial products, whose long-established costs have been determined by competition and whose prices have been frozen by OPA, must be exempt from renegotiation unless efficient operation is to be penalized and wasteful, high-cost manufacturing rewarded.

Maybe Mr. Lincoln has something there.

Networks Growing

UNTIL the war intervened the a.c. networks were growing in favor and when peace comes the 1940-? plateau on the curve will surely stir itself into a new rise. The E.E.I. transmission and distribution committee's report for 1938-40 operation when compared with the 1936-37 report is ample authority for the assertion. Installed transformer capacity and peak loads on the networks both increased more than 25 percent in the interim. The transformers totaled 4,065,355 kva. and the peak aggregated 1,781,729 kva. for the 69 companies which reported on 253 networks functioning in 145 localities at the end of 1940. Consolidated Edison of New York has 15 networks averaging 148,000 kva. each. The other companies average 7,500 kva. per network area.

Highlights in this comprehensive report have meaning for others than just those engaged in network operation. For example, all but one of the companies use automatic network protectors (fused in every instance), but only one employs pilot wires to manipulate protectors or breakers. Incidentally, the reports embrace 11,184 protectors. Twenty companies are now using limiters, fifteen more than in 1937.

Rubber-lead, non-lead and paper-lead cables are in favor to the respective percentages of 50, 28 and 21 of the total of 17,444 miles of secondary cable. Most of the cable failures burned less than 10 feet of cable. The preference for the cable makeups is not exactly in the reverse order of failure rates per 100 mile-years; paper-lead was 3.3, rubber-lead 1.04 and non-lead 0.67.

Oil-filled transformers make up 87.5 percent of the total kva. capacity, non-inflammable fluid-filled 11.7 percent.

Outages are still due principally to primary failures, but the experience has shifted so that these are more attributable to failures at the generating source than to the transmission lines.

Just such candid and detailed recording of experience instead of holding people back is the very thing that is needed during the initial years of a development to convince people that the method is sound and becoming more so all the time.

Washington Comment

R. N. LARKIN, Washington Correspondent

The Plans and Plots of Mr. Ickes

HAROLD L. ICKES, Interior Secretary, has been getting most of his publicity recently from his activities as wartime administrator of coal, oil and fisheries.

He has never lost sight, however, of his long-standing dream of an electric power empire west of the Mississippi River, in which as much as possible of the generating capacity would be publicly owned—and all of that controlled by the Interior Department. With his customary opportunism, Ickes has recently completed a long step in this direction. Another of equal proportions seems now to be in the making.

Ickes was recently awarded authority over the marketing of power generated at Denison Dam, in Texas; at Pensacola Dam, in Oklahoma, and at Norfork Dam, in Arkansas. This authority came in a broad executive order which stipulates that private companies are to get, at best, the last call on available power. Since the three dams will have a total installed capacity of approximately 100,000 kw. when all get into operation early next year, Ickes has been given the essentials of an integrated system which could be a potent competitor to private operators of the south central region. The directive snatched jurisdiction over Norfork and Pensacola power away from the Federal Works Agency (ELECTRICAL WORLD, June 26, 1943, page 56), thus assuring Interior full control over one of the important blocks of public power in its chosen area.

"In That Order"

The broad executive order provided not only that Ickes market Denison, Norfork and Pensacola power, but also that the Corps of Engineers provide transmission facilities to markets Ickes chooses to serve; that the power go to "war plants, public bodies and co-operatives, and other persons, in that order"; that Ickes construct such interconnection facilities as may be required, and that Ickes is authorized to use privately owned facilities on a "common carrier" basis at essentially his own or at Federal Power Commission terms.

Inasmuch as this constitutes the first extension beyond FPC of the authority to commandeer private facilities for "common carrier" use, Ickes has added materially to his powers, over and above his control of an important block of capacity.

An Assist by REA

Not yet an accomplished fact, but definitely in progress, if Interior sources are to be credited, is a drive to transfer the Rural Electrification Administration to Interior from its present home in the Agriculture Department. This move is being pursued, with typical Ickes opportunism, as a result of the present unrest in REA, the pressure being applied by the National Rural Electric Co-operative Association (ELECTRICAL WORLD, July 10, 1943, page 66), and that threatened in the pending investigation of REA slated by the Senate agriculture committee (ELECTRICAL WORLD, July 17, 1943, page 9). There is some argument as to whether the transfer should be made by executive order before Congress returns to take up the investigation or whether it should await the findings of the Senate committee. Inasmuch as the committee will consider whether REA should resume its original status as an independent agency, it would be no surprise to find the conflict resolved by an executive order.

Such a move, of course, would give Interior a made-to-order market for much of its power which is now serving war loads, but for which new buyers will have to be found after the war. These new markets will be particularly important, for if Interior has capacity to spare when the war loads pass out of the picture, there is small reason to believe that Congress will appropriate money for further development of the western power empire at the rate Interior would like to have it do so.

The transfer would leave many REA co-operatives considerably less dependent on private energy sources than they now are, a factor which could not help but please those public power advocates who not only want to see public ownership flourish but who like best to see it flourish at the expense of private ownership.

More Lines Possible

Furthermore, if Congress refuses to deny Interior the right to construct and operate high-tension transmission lines when it considers the question this fall (ELECTRICAL WORLD, July 17, 1943, page 6) REA's affiliation with Interior would provide the best kind of a reason for the latter to erect many more such lines.

Another angle from which it would be to Interior's advantage to control REA lies in REA's authority to loan money to co-operatives for the construction of generating stations. With REA under Interior control, such loans could be made on a strategic basis which would be aimed not only at freeing co-operatives from dependence on private companies but also at providing steam plants with which to firm up the hydro Interior controls.

These are only two thrusts in the continuing drive which Interior has been conducting on numerous fronts in the long-range struggle to bring about public ownership on as vast a scale as possible. The Shasta-Oroville line, first and most important leg in a transmission system for north central California, is a third. Interior's Columbia River Authority bill, when it is presented to Congress, will be a fourth. The insistence that the potential oil shortage on the Pacific Coast requires more hydro capacity in the Northwest is a fifth. The joint attempt by the Army Engineers and the Bonneville Advisory Board to raise the levels of Flathead Lake and Lake Pend Oreille (ELECTRICAL WORLD, June 17, 1943, page 9) is a sixth. None of these will bring aid or comfort to private ownership.

NEWS OF THE WEEK

27 "Critical" Utility Jobs Listed by WMC

Three-point program promulgated aimed at keeping workers on jobs, recruiting new workers from non-essential occupations and filling manpower quotas of armed services with minimum dislocation

Twenty jobs previously listed as essential occupations in the electric utility industry by the War Manpower Commission are included in WMC's latest list of 149 critical occupations, the practice of which will give fathers extra opportunity for occupational draft deferment. Seven other occupations not previously listed as essential were included on the critical list.

Three-Point Program

The new list was promulgated last weekend by WMC in a three-point program aimed at keeping war workers in their jobs, at recruiting new war workers from non-essential occupations and at filling manpower quotas of the armed services with a minimum of dislocation in essential war or war-supporting industries.

WMC's new program included an expanded list of non-deferrable occupations, with a warning to pre-Pearl Harbor fathers that they will face induction if they remain in the proscribed jobs after October 1. Those who switch to "war useful" jobs, WMC promised, will be considered for occupational deferment on much broader grounds than have heretofore been recognized by local draft boards.

Under the new program local draft boards will be asked to consider replaceability as "of paramount importance," and to judge replaceability on the basis of the shortage of the registrant's skill in the total labor force; the shortage of workers with which to replace the registrant, even though he may be unskilled, and on the basis of any local labor shortage, even though no national shortage in that occupation exists. These rules are considerably less stringent than those which have governed occupational deferments during recent months.

Local draft boards still retain final authority over the classification of their registrants except in the case of appeal beyond the local board. Those which have scruples against drafting pre-Pearl Harbor fathers while many young, single men remain at home on occupational deferments will get an even better chance to defer those fathers who get into essential work than they have had in recent months.

Old List Not Replaced

WMC pointed out that the new list of critical occupations does not replace or do away with the existing lists of essential occupations in essential industries. Thus, the 43 electric utility occupations listed as essential in Occupational Bulletin No. 30, issued last March 1 by National Selective Service, are still grounds for occupational deferment, and the 18 jobs which appear on both lists apparently merit double consideration by local boards. The occupations listed solely as essential, however, will not command the same consideration for deferment as those listed as critical. Thus it can happen that holders of seven jobs which are not listed as essential but are listed as critical can get more consideration for deferment than can holders of merely

FOUR DECADES OF SERVICE—George S. Williams, vice-president and general manager Central Maine Power Co., receives a 40-year service pin from president W. B. Skelton. L. to r., H. D. Jennings, treasurer; Mr. Williams; Mr. Skelton; E. P. Noyes, safety engineer and clerk of the Old Timers Club, and Wm. F. Wyman, general superintendent

essential jobs, even though last March the seven jobs now listed as critical were not important enough to be considered essential.

WMC officials stated that the new program is an attempt to avoid the necessity of a national service act, under which the government would draft workers as it drafts soldiers. Executive WMC Director Lawrence A. Appley was quoted as saying that such legislation may be expected if the present program fails.

In exchange for the special consideration which will be accorded them for occupational deferment, holders of any of the 149 critical jobs will give up in even larger measure than heretofore their mobility. They will virtually be frozen in these "war useful" critical jobs, permitted to shift jobs only on referral by, or in accordance with arrangements with, the United States Employment Service.

Other Aspects

The new program also:

1. Delegates broad powers to regional and area manpower officials, permitting them, after consultation with local labor-management committees, to impose drastic controls over movement of any workers.
2. Liberalizes the rules under which workers may shift jobs because of pay standards. USES or the employer may grant certificates of availability, allowing essential workers to change jobs, where substandard wages are paid, and USES may grant releases to workers whose employers fail to comply with WMC rules and regulations.
3. Place national controls over movement of workers between labor markets. Immigrants into a labor market who have not resided therein for at least 30 days may be employed only through USES.

Electric utility occupations listed both as essential, in Bulletin No. 30, and as critical in the new program, are as follows:

Blacksmith, all around; boilermaker, all around; bricklayer, refractory brick; cable splicer, telephone, telegraph or submarine; electrical tester, power equipment; electrician, installation and maintenance, all around; engineer, turbine or diesel; engineer, professional or technical; engineering draftsman, design; foreman; inspector; instructor; lead burner, all around; lineman, telephone, telegraph or power, all around; load dispatcher, power or gas; machinist, all around; radio communications technician; refrigerator equipment repairman, gas or electric, all around (listed as essential on Occupational Bulletin No. 31, covering repair services); sheet-metal worker, marine, all around; and switchboard operator, power.

Included under the designation foreman are only those individuals who are utilizing the knowledge and skills of one or more of the critical occupations, and those who supervise directly or indirectly production, technical or scientific work in essential activities, even though the workers they supervise may not be listed as critical.

Included under the designation inspectors are only those workers qualified to perform in one or more of the critical occupations and who use this knowledge or skill in their work to assure uniformity and accuracy of products or services.

Included under the designation instructor are only those workers who are qualified to perform in one or more of the critical occupations and because of their aptitude and experience have been assigned as instructors.

Other Critical Occupations

Other occupations listed as critical, but not included on the essential list of Bulletin No. 30 are the following:

Cable transmitter and receiver; electrician, aircraft, marine, power house or submarine cable, all around; instrument maker and repairer, electrical, mechanical or scientific; jointer, submarine cable; mechanician, communications equipment; supervisor, and x-ray equipment serviceman.

In some plants, WMC explained, supervisory personnel may be designated by other than supervisory titles, and where they meet the requirements outlined for foremen, they are included as holding critical jobs.

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OPA Allows Utilities to Fix Own Ceilings

Surplus inventory items resold under new regulation

Maximum Price Regulation 204, governing sales of iron, steel and copper products and other essential war items from idle or surplus industrial inventories, has been revised by the Office of Price Administration to allow utilities to establish their own price ceilings on materials sold to another utility.

Seller's Book Cost

Under the amended regulation, maximum price f.o.b. point of shipment for any item sold by one utility, as defined by Order U-1, to another utility shall be the seller's book cost. Book cost is defined as the average net price paid by the seller plus purchasing, warehousing and related accounting costs attributable to the material and actually paid by the seller. These handling costs may not exceed 10 percent of the average net cost. In calculating the average net cost all discounts or other deductions by which the seller benefited must be deducted, and any transportation or delivery charges actually paid by the seller may be included.

The amendment, OWU officials estimate, will affect about 50 percent of the sales of new wire and cable from surplus inventories of electric utilities. The other 50 percent are sales made to non-utilities, in which case the maximum price is the present maximum price of similar wire or cable purchased from the manufacturer in amounts comparable to those in which the surplus wire and cable was originally purchased. Freight charges may be included in the maximum price, but not warehousing or other handling charges. New wire and cable are the two principal commodities handled by utilities which are affected by MPR 204.

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Appeal Detroit Edison Rate Case

Michigan Public Service Commission's order denying the city of Detroit's plea for a reduction in the rate of Detroit Edison Co. (ELECTRICAL WORLD, July 31, page 4) has been appealed to the Michigan Supreme Court. The city's petition had asked for rate reductions totaling $8,000,000 a year on the argument that excess profits taxes should not be included as operating expenses of a utility company.

In filing the application with the Supreme Court, requesting permission to appeal the order, assistant corporation counsel James H. Lee said the court will be asked to determine whether or not the commission has authority to allow the excess profits taxes in establishing reasonable rates as charges against the consumer. The commission held in its decision that it had no legal authority to set aside such taxes when considering reasonable rates.

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FPC Authorizes North Dakota Merger

The Federal Power Commission has authorized the Otter Tail Power Co. to acquire the outstanding bond, stock and open book account indebtedness of the Interstate Power Co. of North Dakota and to merge the facilities of Interstate with those of Otter Tail. In addition the commission's order approved the transfer from Interstate to Otter Tail of a Presidential permit of August 1, 1941, authorizing the operation of a substation in North Dakota at the international boundary line for the importation of electric energy from Manitoba, Canada, into the United States.

Approval of the proposed merger has already been granted by the Securities and Exchange Commission.

eply Briefs Filed in Southwest Pool Rate Case

ansas commission urges FPC to repudiate acts of counsel and "stay within powers granted by Federal Power Act" — FPC claims jurisdiction over costs of special service facilities

he Federal Power Commission was ed to "stay within the powers nted it by the Federal Power Act to repudiate the acts and conduct s counsel . . ." as the commission's stigation into reasonableness of s charged by members of the South- Power Pool neared decision.

he suggestion was made by the ansas Department of Public Utili- in its reply filed with FPC recently. eply brief filed by the respondent panies of the pool attacked FPC's ition on nearly a score of points, le FPC's reply brief assailed re- ndent's brief as full of "unwarranted, upported and misleading statements implications . . ."

Arkansas Reply Brief

he Arkansas Department closed its f with the statement that it "re- ctfully suggests that the only plausi- and reasonable course for FPC now o stay within the powers granted it the Federal Power Act; to repudiate acts and conduct of its counsel in ecting into the investigation matters within the purview of the order ecting it, and insisting that an in- tigation may be ordered for one pur- e, a purpose within the jurisdiction the commission, and then be con- ted into an investigation for purposes expressed in the order or within power or jurisdiction of FPC; that C should decline to assume juris- tion of any rate involved in this se and that especially should it line to assume jurisdiction of rates arrangements between Arkansas wer & Light and the Defense Plant rporation."

f it followed the suggestion of its nsel, the Arkansas Department rned FPC, it would "take jurisdiction and exercise power to regulate local es and thereby usurp and exercise wer reserved by the Constitution to sovereign states." In addition, FPC uld warn the public "that it cannot ord to accept the statement of pur- e of an investigation to be made FPC, since an investigation started one purpose may, without notice, compass any other matter within the ims of counsel for FPC."

Reply briefs submitted by FPC and pool members attacked points made by the other in briefs submitted early in July (ELECTRICAL WORLD, July 17, 1943, page 3). The pool brief charged that the real purpose of the investigation was to reduce the retail rate charged Defense Plant Corporation for service to its Lake Catherine, Ark., aluminum plant by the Arkansas Power & Light Co. It asserted that section 206 (A) of the Federal Power Act does not give FPC jurisdiction over such rate. FPC's contention that it could force a reduction of retail charges by indirection is "preposterous," the pool reply brief argued, denying also FPC's point that no charge could be made for use of equipment and facilities unless the delivered power was firm power. Anyway, the pool argued, the power furnished is firm.

The pool denied FPC's contention that principal participants of the pool got excessive returns with the argument that they received 2.802 mills per kw.-hr. for their energy, while the limited participants got 3.044 mills per kw.-hr., a figure which FPC counsel agreed was "unobjectionable."

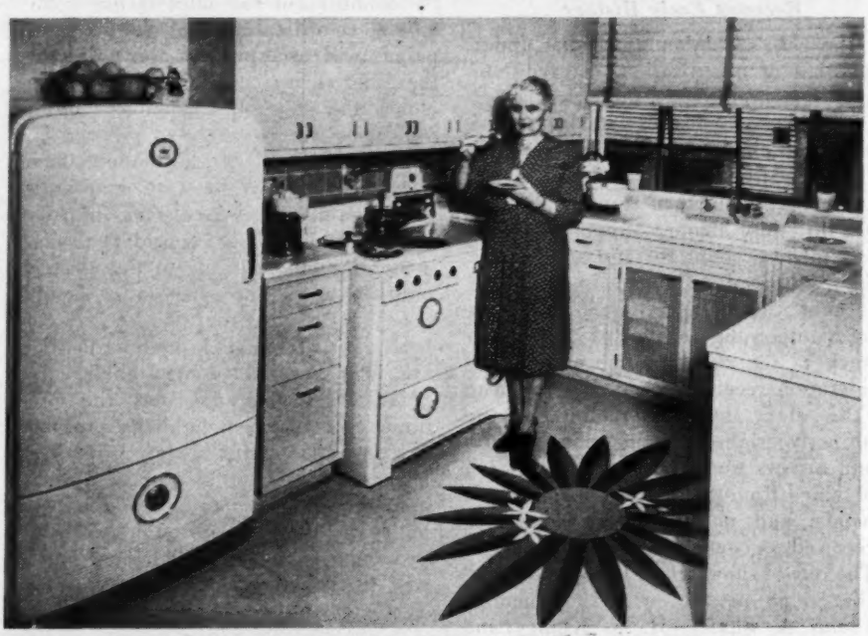
FPC has no jurisdiction over charges for special facilities and has no authority to reduce payments to Arkansas Power & Light for such facilities, the pool argued.

FPC Reply Brief

FPC's reply brief charged that the "outline of testimony (by pool members) was designed to fill the record with irrelevant and immaterial details relating to extraneous and inconsequential matters . . ." It argued that certain of the special facilities installed by the pool were "obviously part of a scheme by the Electric Bond & Share holding company to provide a channel between its now-isolated properties in Kansas and Nebraska and its properties in Arkansas, Louisiana, Mississippi and its property in Texas."

FPC insisted that it has jurisdiction over cost of special facilities for, "in order to determine the proper charge for the service, the commission is required to consider the reasonableness of both the amounts received as compensation for energy generated and those received as a return of capital. It is the total charge for the service which must be reasonable and proper."

In answer to points made in respondents' brief that FPC attempted to submit its own judgment for that of "responsible management of companies." FPC argued in its reply brief that "not to do so would be a refusal to administer express provisions of the Federal Power Act." It argued further



SUNKIST KITCHEN—Sunkist recipes, famed for their excellent suggestions for cooking with citrus fruits, are tested in an all-electric kitchen at the California Fruit Growers Exchange, Los Angeles. An electric range, refrigerator, mixer and ice cream freezer are included in the kitchen's cooking facilities. Miss Essie L. Elliott is head of the home economics department of the exchange

that every action by a regulatory commission in reducing rates, reducing amounts classified as plant, refusing permission to abandon service, or ordering cessation of unjust discrimination, constitutes a substitution by a commission of its own judgment for that of management. Without such action, FPC argued, there could be no regulation.

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FPC Cites Indiana Hydro on "Write-Ups"

The Federal Power Commission has directed the Indiana Hydro-Electric Power Co. to make accounting adjustments involving the disposition of over $3,500,000, established in account 107 (electric plant adjustments), in the process of reclassifying the company's accounts and determining the original cost of the company's electric plant.

The company's original cost studies showed the original cost of Indiana's electric plant and other physical property, as of January 1, 1937, to be $5,609,289.80 and electric plant adjustments of $2,506,095.72, or a grand total of $8,115,385.52. The original cost has been further reduced, the commission said, $1,083,671.73 by the present order which results in an original cost of electric plant and other property of $4,525,618.07 and brings the total adjustments to $3,589,767.45. Thus the amount to be disposed of represents an excess of about 80 percent of the original cost of the company's electric plant.

Recount Early History

The FPC's opinion states that under the plan of organization, entered into on December 17, 1921, there was issued $3,500,000 of common stock, all of which was charged to the plant account. The company proposed, in its reclassification of accounts, to transfer $2,625,000 of this amount from its plant account to account 107 and at the same time proposed to retain in its plant account the balance of $875,000 recorded upon the issuance of its common stock as the alleged value of the consideration received for such stock. The FPC staff, however, maintains the property rights, engineering reports and surveys were fully paid for in cash obtained from the sale of the company's bonds, and no additional value was received as consideration for the stock. The record shows, the FPC opinion said, that none of the original promoters (John A. Shafer, H. E. Kinney and H. P. Wilson) owned any of the property conveyed to the company and that the surveys and engineering services rendered by them were fully paid for in cash.

E.E.I. Group Indorses Conservation Drive

Cleveland meeting brings together 75 utility company executives, who adopt recommendations aimed at gearing electrical industry's drive to over-all industry campaign — Sept. 15 is deadline

Another group of electrical utility executives has indorsed the voluntary conservation program drawn up for the industry by the Office of War Utilities' task committee (ELECTRICAL WORLD, July 24, page 63). Approximately 75 executives indorsed the program last week at a meeting in Cleveland, sponsored by the Edison Electric Institute. Engagements on behalf of the industry which the program entails were also indorsed.

Sept. 15 Deadline

The meeting adopted a series of recommendations aimed at insuring that the electric industry program be geared closely to the programs of the other industries which are joining in WPB's over-all conservation drive. The recommendations were based on the generally accepted idea that it would be difficult to carry out the over-all program if all industry campaigns were not ready to go ahead at the same time.

Recommendations call for all electric utilities to be ready to embark on the programs September 15. Electric industry members of the inter-agency committee, co-ordinating the over-all campaign, will ascertain at a meeting of the inter-agency committee later this month the degree to which the other industries will be ready to proceed on September 15. Should any other industries not be ready to start their campaigns on that date, the electric industry task committee will consider recommendations to be made to the electric industry as to the position it should take.

If, as is anticipated, other industries are in a position to open their campaigns September 15 and the preliminary government publicity program is ready, the inter-agency committee members will report this to the electric industry task committee, which will notify the industry, through E.E.I., to proceed as scheduled. This final notice will be delivered to utilities between September 5 and September 10.

Committee Members

Electric industry members of the inter-agency committee are H. C. Blackwell, president of the Cincinnati Gas & Electric Co.; Philip Sporn, vice-president of American Gas & Electric Service Corp., and Walton Seymour, director of the Department of Power Utilization, Tennessee Valley Authority.

Meanwhile, at a meeting early this week of the steering committee directing the over-all conservation campaign, progress reports on programs of the coal, transportation, oil and communications industry were received. Only official statement on the meeting was that the committee expects the over-all program to begin September 15 as scheduled.

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Voters May Decide Nebraska Power Sale

Following the passage in the Nebraska Legislature of a bill, designated as LB 204, authorizing the city of Omaha to purchase outright the properties of the Nebraska Power Co., latest reports would appear to indicate that the matter will yet go into the hands of the voters for a final decision. More than 47,000 names have been signed to a petition requiring the city council to enact an ordnance which, if passed, would require a majority vote of the qualified electors of the city to express their will on the matter of a revenue bond issue to finance the deal. All available signs point to a close vote on the question.

It is pointed out, too, that the power of the city of Omaha to condemn the properties with the intention of taking them over is based on the assumption that the voters will approve the bond issue. Nebraska Power, through J. E. Davidson, president, has announced that it does not want to sell the property to the city. Further, there is no provision in the SEC order to American Power & Light Co., the parent concern, requiring that the property be sold—merely that American, under the "death sentence" provisions of the Holding Company Act, divest itself of its interest in the company, which could be accomplished by a distribution of the securities.

The bill, LB 204, becomes law at the end of August.

Taxes Up 8% for Quarter; June Revenues Show Gain

Federal Power Commission reports show a 64 percent jump in excess profits tax, 11.9 percent drop in income tax, gain of 2.2 percent in local levies — Operating revenues up 9 percent

Total taxes charged to electric operations of the larger privately owned electric utilities in the United States in the second quarter of 1943 were reported to be $166,328,000, as compared to $153,680,000 in the second quarter of 1942, an increase of 8.2 percent, according to a statement issued today by the Federal Power Commission.

Dividends Up 3.1 Percent

Total dividends for the second three months of 1943 amounted to $98,480,000, as compared with $95,547,000 in the same period of 1942, an increase of 3.1 percent, the report shows, while salaries and wages in the second quarter of this year increased 4.1 percent to $121,967,000 from $117,155,000 in the second three months of 1942. The statement points out that in reporting salaries and wages charged to electric operations certain of the respondents include salaries and wages of other utility departments and others do not include charges to clearing accounts.

In the federal tax bracket excess profits taxes increased 64.0 percent to $45,844,000, income taxes were down 11.9 percent to $48,198,000 and other federal taxes increased 0.2 percent to $15,098,000, bringing the total federal taxes for the second quarter to $109,140,000, an increase of 11.7 percent over the total of $97,729,000 in the second quarter of 1942. State and local taxes increased 2.2 percent to $57,188,000 over $55,951,000 in the second three months of 1942.

Dividends on preferred stock in the second quarter of 1943 were $30,342,000, or 1.0 percent below the $30,632,000 figure for 1942, and common-stock dividends increased 5.0 percent to $68,138,000 from the 1942 figure of $64,915,000.

Revenues Up 9 Percent

Electric operating revenues of the larger privately owned electric utilities in the United States in June 1943 were $240,503,000, as compared to $220,623,000 in June, 1942, an increase of 9.0 percent, according to another FPC report.

Revenues from sales to ultimate consumers were up 9.4 percent to $217,439,000 and electric operating revenue deductions (including operating expenses, depreciation and taxes) were $186,795,000, or 8.8 percent over those of June, 1942.

Net electric operating revenues increased 9.7 percent to $53,708,000, and gross income, including other utility operating income, increased 8.0 percent to $63,216,000. Income deductions decreased 3.0 percent to $24,341,000. Net income in June, 1943, was $38,875,000, an increase of 16.3 percent over the net for June, 1942.

Revenues by classes of service in June, 1943, compared with the same month of 1942 were as follows: Industrial, an increase of 16.4 percent; residential, an increase of 6.2 percent; commercial, an increase of 1.1 percent. Operating expenses in June, 1943, were $106,790,000, or 11.0 percent greater than those of the same month last year. Depreciation charges were increased 6.7 percent to $24,687,000 and taxes increased 4.6 percent to $54,465,000.

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S.C.E. "Dehydrates" Transformers

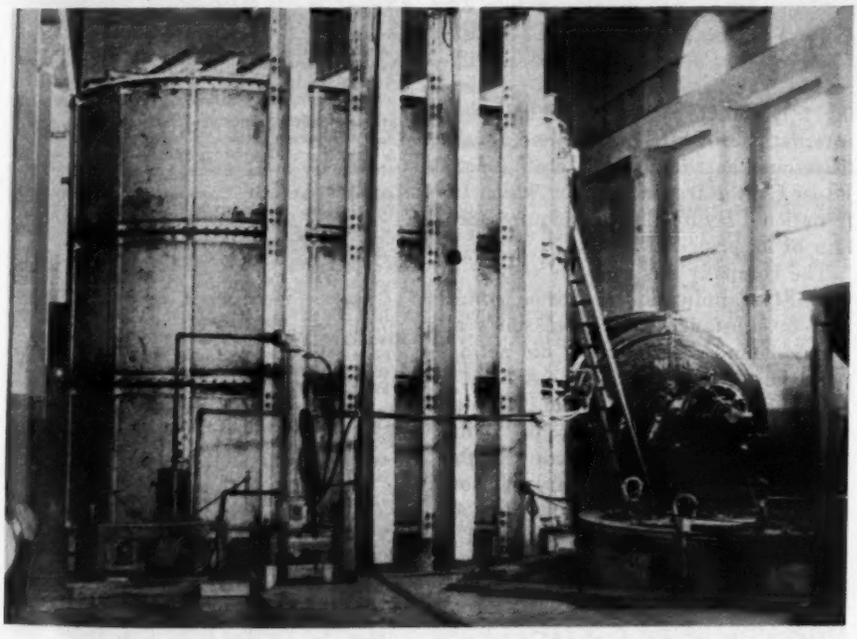
The Southern California Edison Co. has "dehydrated" about 140,000 kva. of transformer capacity in a vacuum dry-out tank at its Vestal substation in the San Joaquin Valley. The tank is oval in shape, has three sections and is thoroughly insulated around the sides and on top. Strip heaters, totaling 144 kw., are placed under the bottom and around the sides. These are controlled by thermostats placed inside the tank. Two 18-in. and two 24-in. "I"-beams are placed on each side of the tank to keep it from collapsing due to the vacuum.

A vacuum pump maintains about 29 in. of vacuum, maximum for the altitude. At that pressure water will boil at 59 deg. F. Thus the moisture in the transformer cores evaporates and is extracted with the pump, to be condensed and measured periodically. Transformer windings are not injured by excessive temperatures as the heat is not allowed to rise above 200 deg. F.

Leads are brought out so that readings may be taken of the core at all times. Five thermohms are placed around the core and connected to a telethermometer on a test panel to check for "hot spots" on the core.

The amount of water removed from a core depends on its design and how much it has been exposed to moist atmosphere. About 30 gal. of water was removed from one core.

Several hundred pounds of filter paper that had absorbed water, but was clean otherwise, was reclaimed by putting it into the vacuum tank with transformers.



S.C.E. VACUUM DRY-OUT TANK—This is the type of tank used by Southern California Edison to "dehydrate" transformers at its Vestal substation

Protest U. S. Control of Norfork Power

Business and agricultural leaders of North Arkansas want the $28,000,000 Norfork Dam used primarily for flood control purposes and prefer that the U. S. Army engineers handle the sale of any power produced rather than the public-power-minded Department of Interior (ELECTRICAL WORLD, August 7, page 68). This was made perfectly clear on August 10, when the Arkansas State Flood Control Commission held a meeting at the dam.

During the first part of the meeting Col. A. M. Neilson, district engineer of the Little Rock district, U. S. Army Engineers, presided, and harmony prevailed. But after John P. Morrow of Batesville, chairman of the Arkansas Flood Control Commission, assumed charge of the meeting the opposition to public power plans became apparent.

Fortas, Wright at Meeting

Senator John L. McClellan of Arkansas started the fireworks when he expressed belief that the Army Engineers, who are constructing the dam, should be authorized to operate the dams when they are completed. Under a Presidential directive operation has been vested in the Department of the Interior. Abe Fortas, representative of the department, was present at the hearing, as was Douglas Wright, who has been designated to arrange for sale of power from the Norfork, Denison and Pensacola dams.

Referring to the Army engineers as "our friends," Mr. Fortas pledged cooperation with local residents and asked them to "give us guidance" in handling the distribution of the dam's power. "This business won't be run from Washington," he promised. "We have gained too much experience in this work at Bonneville and Grand Coulee dams in the Northwest. We sell power there to private utilities and rural co-operatives and to municipalities; in fact, to any one who wants it," he asserted.

A. P. & L. Has Line

Mr. Wright said he would assume his duties in connection with Denison, Pensacola and Norfork dams on September 1. He pointed out that the only transmission line now connected with Norfork is that of the Arkansas Power & Light Co., which extends from Norfork south to the company's Newport substation. The line is built for 154,000-volt operation, with step-down to 110,000 volts at Newport. Another line northward from the dam to Ozark Beach, Mo., to interconnect with the Empire District Electric Co. system was started by A. P. & L. last year, but construction on it was halted by WPB.

In addition to Mr. Fortas, other public power proponents at the meeting included Arthur Goldschmidt, acting director of the Interior Department's power division.

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SEC Asks Court to Enforce Utility Order

International Hydro-Electric not to oppose dissolution move

The Securities and Exchange Commission last week filed an application with the U. S. District Court for Massachusetts, under Section 11 (d) of the Holding Company Act, requesting a court order enforcing the International Hydro-Electric System to liquidate and dissolve in compliance with a commission "death sentence" order, dated July 21, 1942. Hearing on the commission's application was set by the court for October 8 and any interference with the proceeding was restrained pending further court order.

Utility in Agreement

The commission announced that it had been advised by the holding company that without the aid of the enforcement order it would be unable to comply with the commission's dissolution order. For that reason, the company said, it was not seeking an extension of time to comply with the commission's order, which expired July 23, 1943. The company, according to the SEC, referred to several practical difficulties confronting it, and also to pending litigation in which shareholders of International Hydro-Electric had a right to rescind as against the International Paper Co. the transactions by which International Hydro-Electric acquired certain of its principal assets.

The company has filed an answer to the SEC's application in Boston admitting in substance the commission's allegations and stating that it did not oppose the relief sought by the agency.

"For some time now," Irwin L. Moore, president of International said, "it has been apparent that some action of this character would be necessary. Various methods of solving the company's complex problems have been considered at length and the board of directors reached the unanimous conclusion that procedure along the lines contemplated by the application is in the best interest of the company and its security holders . . ."

MEETINGS

American Society of Agricultural Engineers—North Atlantic Section, Hotel Belmont Plaza, New York, N. Y., September 26-27. R. J. Bugbee, secretary, 121 West St., Rutland, Vt.

Previously Listed

International Association of Electrical Inspectors—Northwestern section, New Washington Hotel, Seattle, Wash., August 26-27; F. D. Weber, secretary, P. O. Box 70, Portland, Ore. Southwestern section, Los Angeles, Calif., week of August 30; H. L. Gerber, secretary, Room 205, City Hall, San Francisco, Calif. Western section, LaSalle Hotel, Chicago, Ill., September 13-15; F. H. Moore, secretary, 320 N. Meridian St., Indianapolis, Ind. Eastern section, New York, N. Y., week of September 20; F. N. M. Squires, secretary, 85 John St., New York, N. Y. Southern section, Roosevelt Hotel, New Orleans, La., September 27-29; C. M. Jones, secretary, 307 Trust Co. of Georgia Bldg., Atlanta, Ga.

American Institute of Electrical Engineers—National technical meeting, Hotel Utah, Salt Lake City, Utah, September 2-4; H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

National Association of Railroad and Utilities Commissioners — War conference, Edgewater Beach Hotel, Chicago, Ill., September 14-16. Ben Smart, secretary, 7411-13 New Post Office Bldg., Washington, D. C.

Municipal Electric Utilities Association of New York State—Annual conference, Lake Placid Club, Lake Placid, N. Y., September 15-17. T. J. McKee, secretary, 200-212 East Third St., Jamestown, N. Y.

International Association of Electrical Leagues—Annual conference, Netherland Plaza Hotel, Cincinnati, Ohio, September 16-17. O. C. Small, secretary, 155 East 44th Street, New York, N. Y.

Pennsylvania Electric Association—Annual meeting and business conference, Wm. Penn Hotel, Pittsburgh, Pa., September 23; A. B. Miller, managing director, State Street Bldg., Harrisburg, Pa. Electrical equipment committee, Benjamin Franklin Hotel, Philadelphia, Pa., October 14-15; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Lexington Bldg., Baltimore, Md.

International Municipal Signal Association—War conference, Hotel Statler, Cleveland, Ohio, September 27-29. Irvin Schulsinger, secretary, 8 East 41st St., New York, N. Y.

Association of Iron and Steel Engineers—Annual meeting, Wm. Penn Hotel, Pittsburgh, Pa., September 28-30. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

American Society of Mechanical Engineers—Joint meeting with Engineering Institute of Canada, Royal York Hotel, Toronto, Ont., Canada, September 30-October 2. Annual meeting, Pennsylvania Hotel, New York, N. Y., November 29-December 3. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

National Safety Council—Congress and exposition, Sherman Hotel, Chicago, Ill., October 5-7. N. H. Dearborn, managing director, 20 N. Wacker Drive, Chicago, Ill.

National Electrical Contractors Association — Drake Hotel, Chicago, Ill., October 10-11. L. W. Davis, general manager, 633 Investment Bldg., 15th and K Sts., N. W., Washington, D. C.

Electrochemical Society — Fall meeting, Pennsylvania Hotel, New York, N. Y., October 13-16. Colin G. Fink, secretary, Columbia University, 3000 Broadway, New York, N. Y.

American Welding Society — Annual meeting, Hotel Morrison, Chicago, Ill., week of October 18. Miss M. M. Kelly, secretary, 29 West 39th St., New York, N. Y.

Engineers Council for Professional Development—Annual meeting, Engineering Societies Building, New York, N. Y., October 23. A. B. Parsons, secretary, 29 West 39th St., New York, N. Y.

National Electrical Manufacturers Association—Annual meeting, Waldorf Astoria Hotel, New York, N. Y., October 25-29. W. J. Donald, managing director, 155 E. 44th St., New York, N. Y.

Joint Fuels Conference—American Institute of Mining Engineers and American Society of Mechanical Engineers—Wm. Penn Hotel, Pittsburg, Pa., October 28-29. T. E. Purcell, chairman, Duquesne Light Company, 435 Sixth Ave., Pittsburgh, Pa.

Week's Output Spurts Upward

The output curve, maintaining the record pace set since the four-billion-kilowatt-hour mark was first breached during the week ended June 12, spurted upward again during the week ended August 14 to a new high. The amount of electrical energy distributed by the electric light and power industry for that week totaled 4,287,827,000 kw.-hr., compared to 4,240,638,000 kw.-hr. the week previous and 3,654,795,000 kw.-hr. for the corresponding week a year ago. The latest week's figure represents a 17.3 percent gain over the 1942 week, according to the Edison Electric Institute.

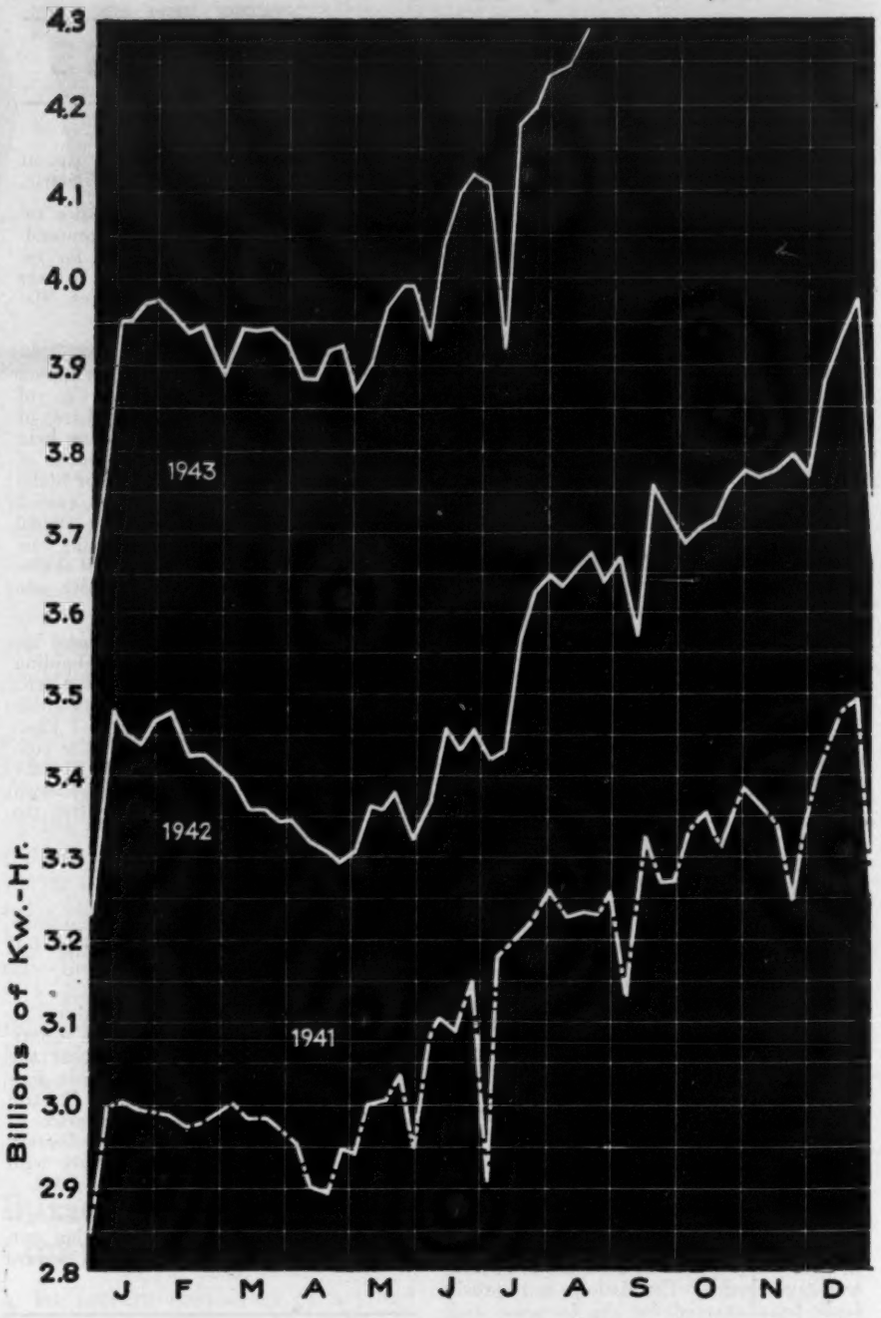
The Rocky Mountain section led the country's seven major geographic regions in increases over last year with 20.5 percent gain, followed closely by both the Southern states and the Pacific Coast regions, which tied at 19.1 percent increase. New England and Mid-Atlantic fell off slightly from the previous week's increase, while the Central Industrial and West Central regions increased their leads over the 1942 week's figures.

Weekly Output, Million Kw.-Hr.

1943		1942		1941	
Aug. 14	4,288	Aug. 15	3,655	Aug. 16	3,238
Aug. 7	4,240	Aug. 8	3,637	Aug. 9	3,233
July 31	4,227	Aug. 1	3,649	Aug. 2	3,263
July 24	4,196	July 25	3,625	July 26	3,220
July 17	4,184	July 18	3,565	July 19	3,199
July 10	3,919	July 11	3,429	July 12	3,178
July 3	4,110	July 4	3,424	July 5	2,901
June 26	4,120	June 27	3,457	June 28	3,157
June 19	4,098	June 20	3,434	June 21	3,091
June 12	4,040	June 13	3,463	June 14	3,101

Percent Change from Previous Year

	Week Ending		
	Aug. 14	Aug. 7	July 31
New England	+ 5.8	+ 8.7	+ 6.7
Mid-Atlantic	+18.3	+19.6	+17.6
Central Industrial	+16.3	+15.8	+14.1
West Central	+17.1	+14.3	+14.2
Southern States	+19.1	+16.6	+16.0
Rocky Mountains	+20.5	+15.4	+16.5
Pacific Coast	+19.1	+18.6	+21.1
Total United States	+17.3	+16.6	+15.8



Water Storage in Good Shape

Midsummer finds the water supplies —ground, surface and storage—favorable to excellent in the northern two-thirds of the United States and in Canada, according to the July report of the Geological Survey of the Interior Department, in collaboration with the Dominion Water and Power Bureau of the Department of Mines and Resources. Stream flow ranged from normal to excessive, and ground water normal to high except in local areas of heavy pumping where some critical conditions have developed. Storage for power, irrigation and municipal use equals or exceeds that of a year ago and is up to the long-time average.

On July 31 of last year, the report said, storage for power was very favorable. This year the amount of stored water available for power, except in Missouri, Arkansas and Texas, equals or exceeds that of a year ago, which also exceeded the long-time average.

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Niagara Falls Asks Rehearing on Petition

Niagara Falls Power Co. last week applied to the U. S. Circuit Court of Appeals for the Second Circuit for a rehearing of its petition to set aside the Federal Power Commission's ruling of June 9, 1942, calling for a write-down of $15,537,943 in the utility's plant account.

The court on July 30 had unanimously affirmed the commission's order.

The FPC order determined the "actual legitimate original cost" of the company's fixed capital, as of March 2, 1921, the date of the issuance of the company's federal license in connection with the diversion of the waters of the Niagara River, to be $24,680,680. The court pointed out, on the occasion when the FPC's order was affirmed, that the case had not been finally closed, the decision excepting the inclusion of "non-project" land items in the determination of original cost.

SEC DECISIONS—HEARINGS

The Securities and Exchange Commission, in a series of orders issued last week:

MODIFIED ITS ORDER of July 2, 1943, to permit Electric Bond & Share Co. to expend $15,000,000 on the New York Curb Exchange or elsewhere to purchase blocks of its own outstanding preferred stock. The original order limited the purchases to the Curb Exchange.

GRANTED THE APPLICATION of Engineers Public Service Co. and subsidiaries for an extension until Jan. 2, 1944, of the time within which the holding company must comply with a commission order of Dec. 29, 1941, directing it to dispose of its interests in the Western Public Service Co., Missouri Service Co. and Northern Kansas Power Co.

APPROVED AN AGREEMENT submitted by the Utilities Employees Securities Co., a part of the Associated Gas & Electric system, and other parties, providing for the distribution of assets of the company. The agreement provides for (1) surrender for cancellation by Uesco of $6,000,000 face amount of obligations of Associated Gas & Electric Corp. and Associated Gas & Electric Co. (2) payment in full of bonds, notes and debentures of Uesco, totaling about $8,000,000, in accordance with terms of their respective indentures (3) remaining assets of Uesco, totaling more than $3,500,000, to be turned over to a trustee for distribution among Associated system companies for employee welfare groups.

AUTHORIZED American Power & Light Co., sub-holding unit in the Electric Bond & Share Co. system, to spend about $8,000,000 in four months to acquire by open market purchases, part of its outstanding gold debenture bonds, 6 percent series, due 2016, and its assumed Southwestern Power & Light Co. 6 percent gold debenture bonds, Series A, due 2016, at prices not in excess of 106 percent of principal amount.

APPROVED Northern Indiana Public Service Co.'s acceptance of a bid by a group of underwriters, headed by Halsey, Stuart Co., for the purchase of $45,000,000 of first mortgage bonds. Permission had previously been granted for the issuance and sale of the bonds at competitive bidding.

REJECTED a voluntary plan submitted by United Corp. to reduce its holdings in utility companies to less than 10 percent, and ordered the company to recapitalize with a single class of stock and go out of business as a holding company. The commission withheld the issuance of a dissolution order and left it up to United Corp. to submit a new voluntary plan to remain in existence by turning itself into an investment company. The structure of United Corp., the SEC said, violated the "great-grandfather" clause of the Holding Company Act by having subsidiary companies which themselves have subsidiary companies which are holding companies. The commission said further that the common stock, with little or no equity, controlled the entire system of United "although the combined book assets of the subsidiary systems are 95 times the equity of the common stock per books of United." United Corp is the parent of four major holding companies—U.G.I., Niagara Hudson Power Corp., Public Service Corp. of New Jersey and Columbia Gas & Electric.

PERMITTED United Corp., at its own request, to become a party to the proceedings involving the voluntary plan for reorganization of Niagara Hudson Power Corp. United owns 23.18 percent of Niagara's voting securities.

GRANTED Electric Power & Light Corp. permission to make a capital contribution to its subsidiary, Idaho Power Co., of 60,000 of the outstanding 150,000 shares of Idaho's $100 par value common stock held by Electric, and all of the 2,670 shares of the $100 par value preferred stock of Idaho which it owns. Idaho proposes to amend its by-laws so that the remaining 90,000 shares of common stock, each having one vote, would be changed into 450,000 shares of $20 par value common, each with one vote.

APPROVED a series of transactions between Associated Electric Co., sub-holding unit in Associated Gas & Electric Corp., and three of its subsidiaries, Tri-City Utilities Co., Owensboro Gas Co. and K-T Electric & Water Co., preliminary to the conveyance to the city of Frankfort, Ky., by Associated Electric, of all the securities of Tri-City that remain outstanding after the proposed transfers are effected.

Applications Filed

During the same week, the commission acknowledged receipt of the following applications:

APPLICATION of Highland Utilities Co., wholly-owned subsidiary of North Continent Utilities Corp., for approval of the proposed sale by it of its Mesa Verde division, in Colorado, to the Empire Electric Association for a base purchase price of $150,000. Proposed sale is part of voluntary plan filed by the parent to comply with Section 11 of the Holding Company Act.

APPLICATION OF National Power & Light Co. amending a previous application outlining certain transactions looking toward the eventual dissolution of the holding company. National's new application states that the company has now developed a program to provide cash for the retirement of its outstanding $6 preferred stock, consisting of 12,000 shares, without using the proceeds from the sale of its holdings of $7 preferred stock of Carolina Power & Light Co., a National subsidiary, as proposed in the previous application.

APPLICATION of a committee of preferred-stock holders in the New England Public Service Co. for authorization to solicit proxies from holders of the company's $6 and $7 dividend series, in order that the committee may represent preferred-stock holders in proceedings before the commission on New England's recapitalization plan, filed December 5, 1941, under Section 11 (b) (2) of the Holding Company Act.

Hearings Scheduled

Hearings on applications, scheduled by the Securities and Exchange Commission last week, included the following:

AUGUST 19: Hearing on proposed transactions of United Gas Corp., subsidiary of Electric Power & Light Corp., and Southwestern Gas & Electric Co., subsidiary of Central & Southwest Utilities Co. Southwestern proposes to sell United all property and assets used in the manufacture and distribution of natural gas in certain areas for $812,500.

AUGUST 24: Hearing on proposal of Southwestern Public Service Co. to sell to Gus B. Walton of Little Rock, Ark., all the outstanding securities of Arkansas Utilities Co. for a basic consideration of $1,725,000.

AUGUST 31: Hearing on voluntary plan of reorganization filed by the North American Co., providing for the divestment by North American of the major part of its utility investments and its subsequent dissolution. The hearing was consolidated with the company's request for an extension of time in which to comply with the SEC's order of April 14, 1942, directing the company to divest itself of all assets except the Union Electric Co. of Missouri.

SEPTEMBER 2: Hearing on the proposed plan of reorganization of American Gas & Power Co., subsidiary of Community Gas & Power Co., recently filed with the commission.

Utility Reports

	Net Income 1943	1942
*American Gas & Electric and subs	$11,441,071	$12,754,062
*American Water Works & Elec. and subs	3,846,883	4,164,873
*Birmingham Electric	1,449,072	984,519
*Carolina Power & Light	2,442,954	2,683,524
*Central Arizona Power & Light	977,163	626,169
*Jersey Central Power & Light	1,779,156	2,061,245
*Minnesota Power & Light	1,963,840	1,444,019
*Northwestern Electric	702,977	567,818
*Pacific Power & Light	1,082,770	669,804
*Pennsylvania Power & Light	5,963,880	5,180,858
*Portland General Electric	1,840,152	1,531,924
*Potomac Electric Power	4,042,904	3,816,677
*Puget Sound Power & Light and subs	4,387,723	3,066,986
*Rochester Gas & Electric	2,949,691	2,224,360
*Utah Power & Light and subs	2,070,227	1,900,583
*Virginia Elec. & Power	4,203,459	3,667,698

*Twelve months ended June 30.

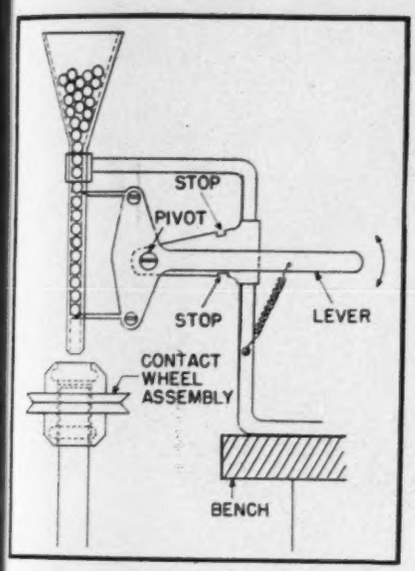
$500,000 Contract Awarded in Indiana

A construction contract in excess of $500,000 has been awarded Todd & Brown, Inc., by the Corps of Engineers, U. S. Army, to provide equipment and facilities at an Indiana ordnance plant for a connection to the transmission lines of Northern Indiana Public Service Co. The contract also covers the installation of three main substations, switchgear, transformers and distribution equipment within the plant. Existing diesel generating equipment now used will be dismantled.

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Ball Bearings Loaded Easily

Loading of ball bearings into contact wheel assemblies for radio transmitters in mass production has been simplified by a fixture devised by W. D. Simpson, an assistant general foreman in the General Electric electronics department.



FIXTURE developed for loading ball bearings into wheel assemblies

The fixture consists of a funnel-shaped hopper with a tubular section attached to its lower end. The inside diameter of the tubular section is just slightly larger than the diameter of the ball bearings so that they will pass through it in line and without congestion.

A lever arrangement pivots from the frame holding the hopper in a manner that pushes two pins through the walls of the tube alternately at two locations. In this particular application the pinholes have been located so that between them there is room for nine ball bearings in the tube. An upward movement of the lever withdraws the lower pin from the inside of the tube, allowing the nine bearings to drop into the contact wheel assembly. The same movement injects the upper pin into the tube, preventing more than nine bearings from entering the assembly. Spring return of the lever to its lower, normal position simultaneously reverses the position of the pins, automatically permitting another nine bearings to fall into the space in the tube between them.

A vertical slot in the side of the tube permits a visual check of the bearings during the operation of the device.

•

Buzzer Tells Driver Lamp Ladder Is Up

To prevent movement of a street lamp maintenance truck while the ladder is up is the purpose of a device described on page 95 of ELECTRICAL WORLD, July 25, 1942. It consists of a metal screen so hinged and moved that vision through the truck windshield is obstructed when the ladder is raised. A variant, perhaps somewhat easier to install and said to be just as effective, was developed from this published idea by the Virginia Public Service Company.

A plunger type, single-pole switch, closed by a spring, was installed above the cab of the truck so that the ladder in the down position holds the switch open. The switch is in series with a good, husky buzzer inside the truck cab and the circuit is energized from the truck battery through the ignition switch. The buzzer sets up a horrendous din inside the cab if the ladder is raised while the truck motor is running or if the ignition is turned on while the ladder is in the up position.

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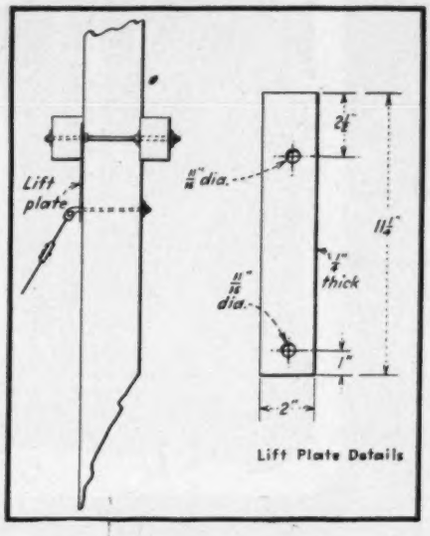
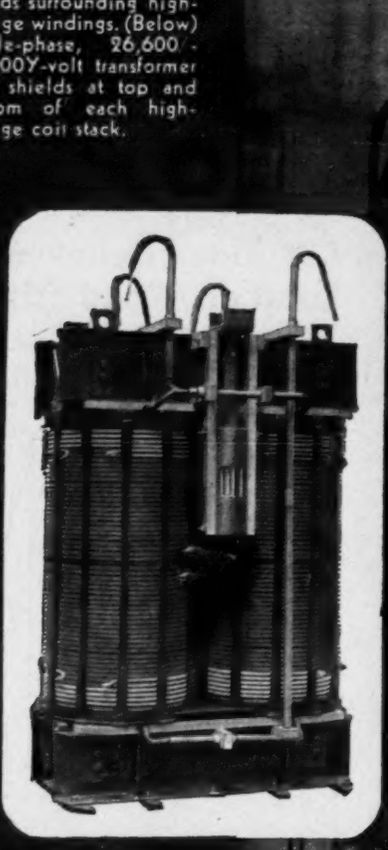
Lift Plate Relieves Load on Wood Fibers



To keep the downward component of guy tension on angle-guy bolts from crushing wood fibers and leading eventually to slack in the guy and possible decay of the wood, Empire District Electric Company, Joplin, Mo., uses the lift plate shown on down guy installations to take part of the load. The plate connects the angle-guy bolt with the through-bolt of the crossarm assembly. The back arm bears on the metal lift plate, a

SHIELDED WINDINGS

TWO TYPES OF SHIELDING. (Right) Single-phase, 36,000-kva, 230,000-volt transformer with shields surrounding high-voltage windings. (Below) Single-phase, 26,600/46,000Y-volt transformer with shields at top and bottom of each high-voltage coil stack.

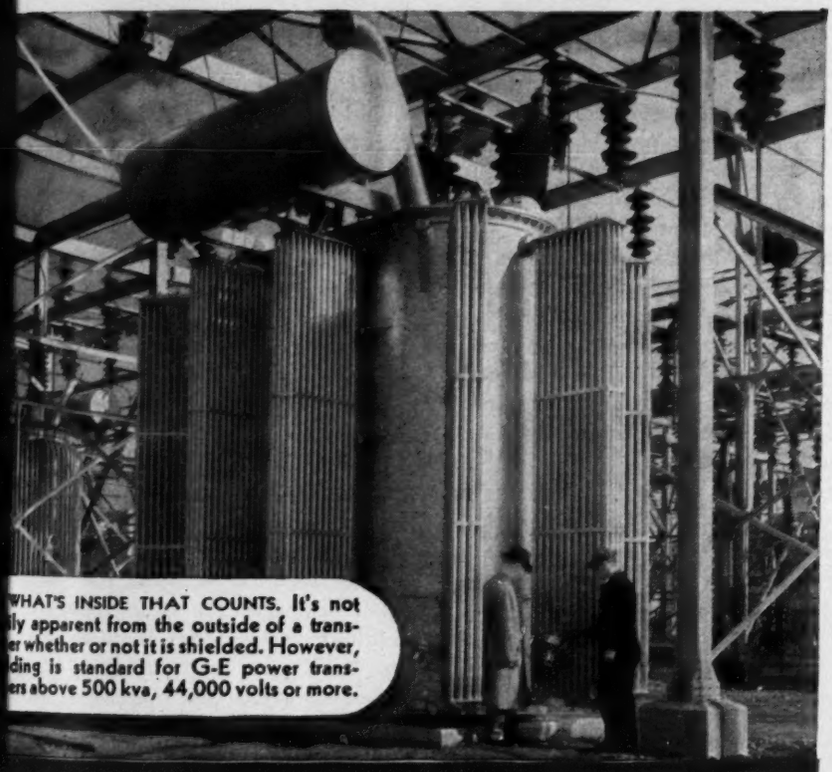


for Real Protection of 3-SHIFT POWER for War Production

500 IN SERVICE Wherever G-E shielded-winding transformers are supplying power—for the production of vital war oods or for the home—they are helping to ensure service continuity.

The G-E shielded winding has proved to be the most nearly perfect eans yet devised for preventing concentrations of voltage stress within wer transformers, which might be caused by switching surges or htning impulses. Shielding enables the transformer designer to know finitely the maximum stress for which he must insulate at each point roughout the winding.

More than 2500 G-E shielded transformers, totaling more than ,000,000 kva, installed over a period of 16 years, are now serving e war effort. *General Electric Company, Schenectady, N. Y.*



WHAT'S INSIDE THAT COUNTS. It's not ly apparent from the outside of a trans- er whether or not it is shielded. However, ding is standard for G-E power trans- ers above 500 kva, 44,000 volts or more.

GENERAL ELECTRIC

What Is a Shielded Transformer?

A transformer is called "shielded" when its winding is equipped with properly insulated metallic surfaces, *connected to the line terminal,* and so proportioned as to effect a radical reduction in the lightning stresses inside the winding.

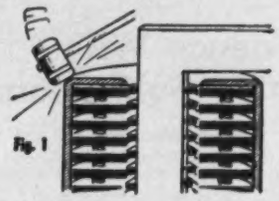


Fig. 1

Why Does Shielding Reduce Lightning Stresses?

Fig. 1 illustrates the effect of a sudden blow on a brittle mechanical structure protected by a steel shield that envelops the corner of the structure. The shield distributes the force of the blow over a sufficient area to *prevent concentration* of stress at any point, enabling the structure to stand, without damage, a blow that would otherwise be destructive. In a similar way, the shield shown in Fig. 2 envelops the corner of the transformer winding and *prevents concentration* of lightning voltage.*

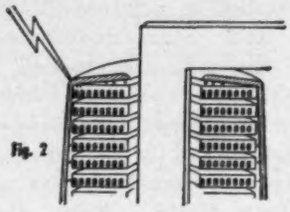


Fig. 2

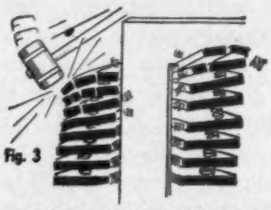


Fig. 3

In Fig. 3, the same mechanical structure, but without shield, is destroyed by a blow of the same severity, because of *concentration* of mechanical stress at the point of impact. This compares with the unshielded transformer winding subjected to lightning impulse, as shown in Fig. 4.

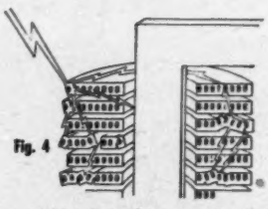


Fig. 4

The G-E shielding principle is as simple as it is effective. External application of the shields permits the retention of all the desirable features of G-E circular-coil construction. For a complete description ask for Bulletin GEA-2303.

**Voltage concentration* at the end *of the winding also causes internal oscillations which produce high-voltage concentrations within the winding, comparable in severity with the initial impact. These oscillations, too, are prevented by shielding.*

condition that tends to prevent rotting of the wood. The gain in the pole is placed facing toward the dead-ended conductors.

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Experience With Portable Substations*

By R. McC. BYERS
Assistant to Electrical Engineer
Consolidated Gas, Electric Light & Power Company of Baltimore

When loads in the suburban districts had grown so much that existing low-tension tie facilities were no longer adequate to provide substation outages, and the 1,000-kva. unit was too small for such work, the Consolidated Gas, Electric Light and Power Company of Baltimore developed a 3,000-kva. design of portable substation in 1939.

In order to meet the existing legal weight limitations, the transformer was specified as a forced oil-and-air cooled unit. Spare and active oil pumps and fans are supplied by a 212-volt delta-connected 1,050-kva. tertiary winding, which also provides for stabilizing of the neutral and flow of harmonic currents to insure correct wave form of the voltage. The oil cooler consists of a double-pass system of seamless tinned steel tubes with a spiral wrapping of copper fins. All fan and pump motors are three-phase and serve as phase rotation indicators.

The same voltages (33-13/4 kv.) and connections are available as on the 1,000-kva. unit but all the operations are controlled by external handles for a series-multiple, high-tension switch and no-load ratio adjusters and by external straps for six low-tension bushings for the three phases. The cover is welded to the tank and the hermetical-sealing condition is checked by nitrogen pressure, oil temperature, and oil-level gages in conjunction with a curve on the name plate.

Switching and cable equipment is somewhat similar to that of the 1,000-kva. unit, but no regulators are provided since substations of 3,000 kva. capacity usually require individual feeder regulation. Substation auxiliary buses and equipment then provide for the low-tension equipment outages.

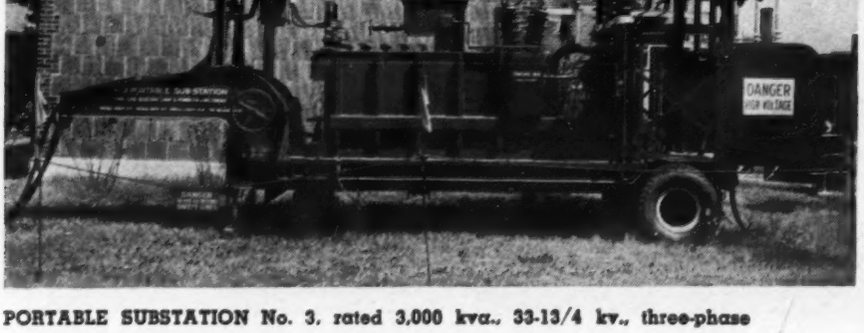
This 3,000-kva. portable substation was constructed at a cost of approximately $6 per kva. and weighed only 21 tons with the largest of the company's tractors. The unit No. 3 is shown in the illustration.

With increasing wartime loads the two (1,000- and 3,000-kva.) portable substations were used more and more to permit essential new construction and maintenance work to be performed at the substations without interruption to vital services. The 3,000-kva. unit was used even more than the 1,000-kva. substation and both were in simultaneous operation at prearranged outages for over half of the time.

Heavy routine usage of the two substations emphasized the fact that another 3,000-kva. portable substation was necessary to provide for emergencies. Preliminary plans and estimates were prepared in 1941, a completely factory-assembled model was ordered in 1942 and is expected to be in service this summer. The design is somewhat similar to the first 3,000-kva. unit except with the addition of load-ratio control equipment and a 13-kv. low-voltage connection. It is estimated that the substation will cost about $10 per kva. and will weigh almost 25½ tons with a tractor. The special 35 mile-per-hour unit is expected to be available for emergency service at any of 46 company substations, at least 15 customers and six government posts.

Thus a family of rural, suburban, urban and emergency portable substations will be serving the radial electric distribution system at a great saving in costs and critical materials in these important war times.

*Fourth and concluding article in a series which began in the July 10, 1943, issue of Electrical World.



PORTABLE SUBSTATION No. 3, rated 3,000 kva., 33-13/4 kv., three-phase

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Ventilation of Substations

In Britain the ARP measures superimposed on the peacetime protection and against fire and explosion have precipitated discussions of the ventilation of substations. Principles followed are typified in a recent I.E.E. paper by Messrs. Favell and Cannon in which they discuss the decisions made concerning a substation comprising two 42x90-ft. brick and concrete buildings 90 ft. apart and housing two 33-kv. switchboards and gear; the two 15-mva., 33/6.6-kv. transformers were outdoors.

Tried first in one switchhouse was a 1-hp. fan injecting 2,000 cfm. into the basement. So much moisture would have been drawn in in wet and foggy weather as to limit fan operation to a few winter hours. Air circulation with leakage deliberately provided was tried in the other switchhouse; air was drawn from the switchroom, warmed by a 12-kw. heater and discharged into the basement. Apparatus-dampness troubles disappeared, but the amount of dirt brought in along with the high expense associated with maintaining low relative humidity led to the adoption of a composite circulation-injection system.

In the circulation-injection scheme finally adopted a ¼-hp. fan brings filtered air into the switchroom from outdoors at the rate of about 200 cfm., one-tenth the circulated quantity. After 43 weeks the range of relative humidity had been 36 to 89 percent (average 68.5), the excess over 80 percent occurring on 34 days. In the interval the fans used 4,530 kw.-hr. in one switchhouse and 236 kw.-hr. was used over 19½ hours. The heaters went on automatically whenever relative humidity reached 90 percent. Gas-

pressure operated switches release CO_2 and shut down the fans in case of fire.

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Lightning Protection Schemes Compared

Comparisons of the relative effectiveness of different types of transformer lightning protection and the savings in annual operating cost to be expected by a change from one form of protection to another are to be derived from a study of lightning performance of 7-kv. and 12-kv. transformers on the system of the Kansas Gas & Electric Company, Wichita.

Basic data for the study, made by H. O. Byers, engineering department, of the Kansas company, is contained in the accompanying tabular summary of lightning experience with 2,216 transformers for the year ended September 1, 1940. Of this group of transformers 598 were without lightning protection, 331 were equipped with arresters, 780 with interconnected arresters, 365 with open gaps and 142 with expulsion gaps. For each transformer group so protected data are given on the number of fuse blowings, winding failures and other types of transformer damage due to lightning, and also the rate of such failures per 100 transformer stations.

Using the data on the change in the rate of failures per 100 stations for different types of protection. Table II was prepared showing the saving in dollars per year per station that would result from changing a station from one type of protection to another. These data, which represent the net saving in operating expense only, are based on an estimated cost of $2.50 to replace a blown fuse, $80 to repair a burned out transformer winding and $35 to repair "other" transformer damage. These unit costs include transformer rewinding, repair, testing, labor and truck expense in removing and reinstalling the transformer.

For example, it appears from this information that if interconnected arresters were installed at all 598 unprotected transformer stations the resulting reduction in the fuse blowing rate per 100 transformer stations from 120 to 15.1 would save 629 lightning-blown fuses at $2.50 or $1,572.50; likewise, lessened winding damage would save 25 burned-out transformers at $80 each, or $2,000, and 28 other damages to transformers costing $35 each, or $980. Total saving would be $4,552 per year, or $7.63 per year for each of the 598 unprotected stations so equipped. Other data in Table II are similarly derived.

Table III, which indicates the cost of installing four types of protection on the 598 unprotected stations, the saving in operating expense per year and the percent return on investment, is based on an assumed installed cost of arresters, interconnected arresters and expulsion gaps of $20 and open gaps $10. The study indicated that the open gap represents the most economical protection. However, the cost of installing outdoor oil circuit reclosers, which should be used with open gap installations, could not be estimated in this study.

Open gaps, however, are not applicable to all line conditions. When flashed over by lightning the gap causes the circuit recloser to operate, resulting in a three-second interruption to the entire line. Most single-phase rural lines can sustain numerous three-second interruptions without objection. Where the character of load, however, is such that continuity of service is essential, the open gaps should not be used.

Arrester and expulsion gaps are self-clearing and should not cause interruption when they operate, it was pointed out in the analysis.

Table I—Performance of Transformer Lightning Protection Year Ending September 1, 1940; Circuit Miles, 1,197

Transformer Station Protection	No Protection		Arresters		Inter connected Arresters		Open Gaps		Expulsion Gaps	
	No.	Percent	No.	Percent	No.	Percent	No.	Percent	No.	Percent
Number of transformer stations analyzed—2,216—100%	598	27.0	331	14.9	780	35.2	365	15.5	142	6.4
FUSES BLOWN ONLY										
Stations having NO fuses blown	281	47	275	83	705	90.4	342	93.8	131	92.3
Stations having 1 or 2 fuses blown	213	36	50	15	68	8.7	18	4.9	10	7.0
Stations having 3 to 5 fuses blown	93	15.5	6	2	4	0.5	4	1.1	0	
Stations having 6 to 10 fuses blown	10	1.5	0		3	0.4	1	0.2	1	0.7
Stations having over 10 fuses blown	1		0		0		0		0	
Total fuses blown	719		88		118		44		17	
Rate per 100 transformer Stations	120.0		26.6		15.1		12.0		12.0	
TRANSFORMER WINDINGS DAMAGED										
Stations having NONE damaged	567		312		771		363		141	
Stations having 1 damaged	29	4.84	9	2.72	9	1.15	2	0.55	1	0.7
Stations having 2 damaged	2		0		0		0		0	
Stations having 3 damaged.										
Total transformer windings damaged	31		9		9		2		1	
Rate per 100 transformer stations	5.2		2.7		1.1		0.55		0.7	
OTHER TRANSFORMER DAMAGES										
Stations having NO other damages	566		327		774		362		141	
Stations having 1 other damage	30		4		6		3		1	
Stations having 2 other damages	2		0		0		0		0	
Stations having 3 other damages.										
Total other transformer damages	34		4		6		3		1	
Rate per 100 transformer stations	5.7		1.2		0.77		0.82		0.7	

Table II—Changes in Transformer Protection Bring Operating Saving

(Dollars Per Year Per Transformer Station)

Protection Changed From	Protection Changed to			
	Arresters	Interconnected Arresters	Open Gaps	Expulsion Gaps
None	$5.91	$7.63	$8.13	$8.05
Arresters		1.72	2.22	2.14
Interconnected arresters			0.50	0.42
Open gaps				
Expulsion gaps			0.08	

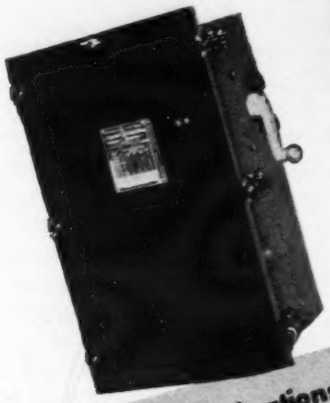
Table III—Cost, Saving, Return from Protecting 598 Transformer Stations

598 Transformer Stations Protected by	Cost Installed	Saving per Year	Percent Return on Investment
Arresters	$24,000	$3,535	14.7
Interconnected arresters	24,000	4,552	19.0
Open gaps (G-10)	11,000	4,872	44.5
Expulsion gaps	24,000	4,827	20.0

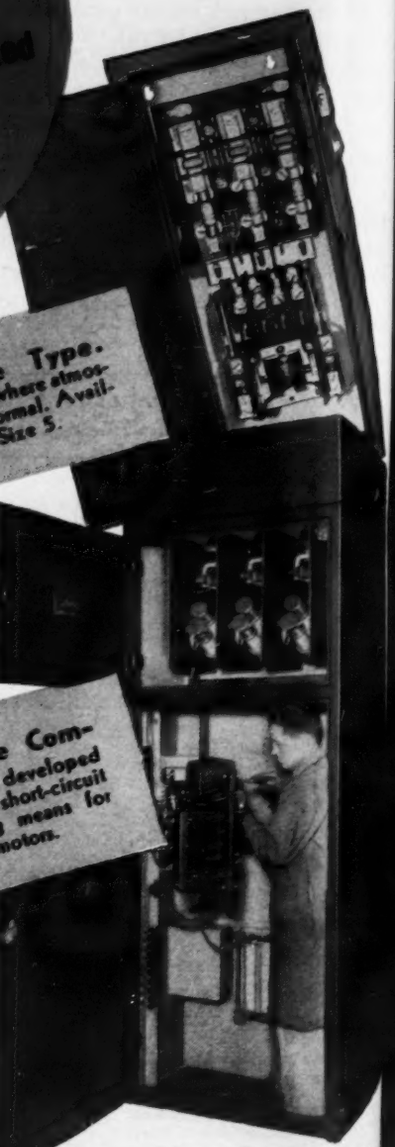
GENERAL ELECTRIC RECOMMENDS

Combination Starters

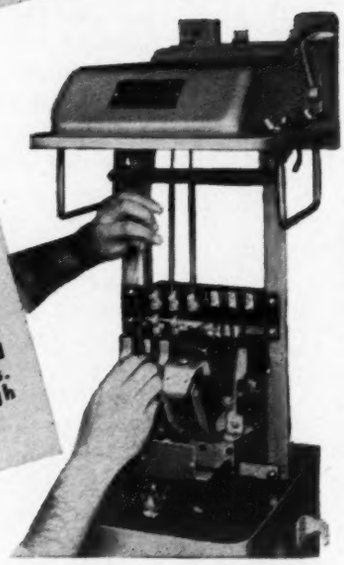
Instead of Separately Mounted Motor-circuit Switches and Starters



Dust-tight Combinations. For extremely dusty locations. Available through NEMA Size 5.



General-purpose Type. For indoor installations where atmospheric conditions are normal. Available through NEMA Size 5.



For Corrosive Locations. Oil-immersed. Two forms—for both corrosive and hazardous locations. Available through NEMA Size 5.

New High-voltage Combination. Recently developed—provides split-cycle, short-circuit protection and starting means for 2300- and 4000-volt motors.

COMBINATION STARTERS for motors from 1 to 1000 h

...cause . . . they save vital materials

● By buying both the motor-circuit switch and the magnetic starter as one compact unit, you save the copper wire, steel conduit, and fittings that are necessary for installing two separately mounted devices—plus the saving gained by using only one steel enclosure instead of the two individual cases required for separate controls.

...cause . . . they can be installed easily by "green" crews

● G-E combination starters eliminate one complete mounting job on every installation—a time saving of up to 50 per cent. They are completely wired at factory, so all you need do is to connect power, motor, and control leads—saving up to 40 per cent in wiring time.

...cause . . . they reduce costly accidents

● Combining the motor-circuit switch in the same case with the magnetic starter makes it possible to mechanically interlock the switch with the door so that the door cannot be opened while the power is on. (With separate devices, there is nothing to prevent the operator from opening a case on a "live" starter.)

Write for these Bulletins

CR7008 FULL-VOLTAGE MAGNETIC COMBINATION STARTERS —BULLETIN GEA-3715

NEW SIMPLIFIED GUIDE TO THE SELECTION AND APPLICATION OF COMMONLY USED MOTOR CONTROL —BULLETIN GEA-4015

General Electric Company, Section E 676-94 Schenectady, N. Y.

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5020

GENERAL ELECTRIC

CIRCUIT PLANNING DATA FROM A DISTRIBUTION ENGINEER'S NOTEBOOK

By C. N. CLARK, Distribution Section Engineer, Duquesne Light Company

In working out the details of primary circuits capable of delivering prescribed loads within prescribed limits of voltage drop it has been found a time saver to have data tabulated in most directly usable form.

For example, Table I of trigonometric functions has the ruling values expressed in terms of 5 percent change in power factor (or 0.05 in cosine) and the angles, sines and tangents given to correspond. This is done because power factor is usually assumed at one of these intervals.

Similarly the volts drop per ampere (Table II) for various size of wires and cables give a quick index of sufficiency of a circuit. This is particularly true if given for a normal operating power factor and also for a power factor value (30 percent) typical of across-the-line motor starting or of lightly loaded circuits with a predominance of transformer excitation, etc.

Minimum values of impedance-ohms of equipment in 4-kv. substations for making calculations of the drops occasioned by starting three-phase motors are given in Table III. These, in conjunction with circuit drops, indicate what voltage can be expected at the motor to sustain starting requirements. Transformers and regulators are included with all bank ratings indicated. Reactors are included above 2,000 kva.

Tables IV and V afford typical starting and load-running data for motors; note the columns which translate locked rotor and starting (65 percent voltage) from 220 to 3,800-volt primary values.

The constants from the tables for circuits and station equipment are added arithmetically and multiplied by the primary currents to obtain approximate voltage drops. Corresponding constants for distribution transformers and secondaries (in primary terms) may also be included where the regulation on the secondary system is required.

Table I—Trigonometric Functions

Cosine	Sine	Tangent	Angle Deg.	Min.
1.000	0.000	0.000	0	0
0.950	0.312	0.329	18	12
0.900	0.436	0.485	25	51
0.850	0.527	0.620	31	47
0.800	0.600	0.750	36	52
0.750	0.662	0.882	41	25
0.700	0.714	1.020	45	34
0.650	0.760	1.169	49	27
0.600	0.800	1.333	53	8
0.550	0.835	1.519	56	38
0.500	0.866	1.732	60	0
0.450	0.893	1.984	63	15
0.400	0.916	2.291	66	25
0.350	0.937	2.677	69	31
0.300	0.954	3.181	72	33
0.250	0.968	3.871	75	31
0.200	0.980	4.901	78	28
0.150	0.989	6.586	81	22
0.100	0.995	9.960	84	16
0.050	0.999	19.970	87	8
0.000	1.000	.....	90	0

Table II—Primary Circuit Voltage Drop for 1,000 ft. of Single Conductor

Conductor Size	Res. Ohms	React. Ohms	Volts Drop per Ampere 30% P.F.	85% P.F.
Overhead*				
No. 4/0	0.057	0.109	0.121	0.106
No. 1/0	0.115	0.117	0.146	0.160
No. 3	0.226	0.124	0.186	0.257
No. 6	0.453	0.132	0.262	0.455
Cable†				
750 M	0.0172	0.0268	0.0308	0.0287
500 M	0.0254	0.0277	0.0340	0.0362
350 M	0.0360	0.0286	0.0381	0.0457
250 M	0.0498	0.0299	0.0435	0.0580
No. 4/0	0.0586	0.0305	0.0467	0.0659
No. 1/0	0.1177	0.0333	0.0671	0.1176
No. 3	0.2320	0.0370	0.1048	0.2165
No. 6	0.4660	0.0414	0.1795	0.4178

* Overhead — 16 in. flat spacing.
† 3/c Cable — 8/64 x 5/64 in. insulation.

Table III—4-Kv. Substation Equipment: Minimum Impedance for 3 Phase Motor-starting Calculations

Bank Kva.	Equipment Ohms	Bank Kva.	Equipment Ohms
300	22.30	3,000	.884
450	1.525	3,750	0.798
600	1.175	4,000	0.778
1,000	0.967	5,000	0.716
1,500	0.967	6,000	0.672
2,000	0.967	7,500	0.631
2,500	0.967	10,000	0.588

Transformers and regulators included in all cases. Reactors included above 2,000 Kva.

Table IV—Typical Operating Data: Squirrel-Cage Induction Motors 3 Phase, 60 Cycles

Motor Size Hp.	Amperes per Phase F.L. 220V.	Locked Rotor 220V.	Locked Rotor 3,800 V.	65% V. Start. 220V.	65% V. Start. 3,800 V.
10	25	188	10.9	80	4.6
15	37	282	16.3	119	6.9
20	49	376	22	159	9.3
25	62	470	27	199	11.4
30	74	560	32	237	13.7
40	98	730	42	309	17.8
50	123	900	52	381	22.0
60	147	1,070	62	455	26.0
75	184	1,330	77	565	33.0
100	245	1,740	101	735	43.0
125	307	2,160	125	915	53.0
150	368	2,570	149	1,085	63.0
200	490	3,400	197	1,440	83.0

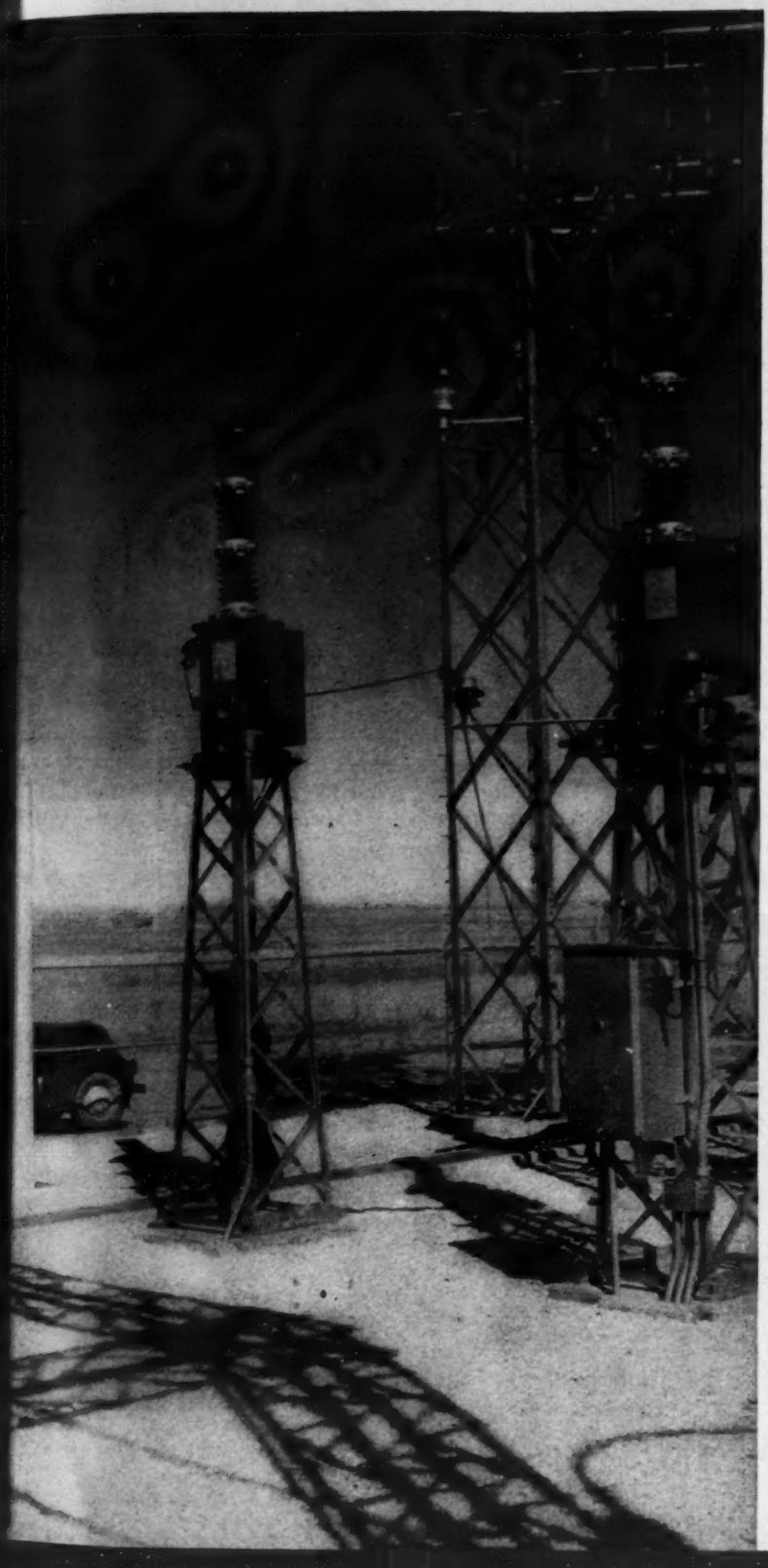
Table V—Typical Operating Data: General-Purpose Synchronous Motors 3 Phase, 60 Cycles

Motor Size Hp.	Amperes per Phase F.L. 220V.	Locked Rotor 220V.	Locked Rotor 3,800 V.	65% V. Start. 220V.	65% V. Start. 3,800 V.
25	53	410	24	175	10
30	63	490	29	210	12
40	84	655	38	275	16
50	105	820	48	345	20
60	126	985	57	415	24
75	158	1,225	71	520	30
100	210	1,635	95	695	40
125	263	2,045	118	865	50
150	315	2,460	142	1,040	60
200	420	3,270	189	1,385	80
250	525	4,090	236	1,730	100
300	630	4,920	284	2,080	120
350	735	5,730	331	2,425	140
400	840	6,550	378	2,770	160

PRESENT power systems

PLUS G-E carrier current

SAFELY deliver more kilowatt hours



MANY power companies—faced with increased power demands for war uses—can deliver more kilowatt hours and stay well within safe operating limits by installing modern G-E carrier-current equipment. Regardless of the type of carrier function needed, General Electric can supply it.

Besides offering all types of carrier-current equipment, an exclusive feature of G-E design is its package-type unit construction. For example, your immediate need may be pilot relaying to improve stability of transmission lines, increase their load-carrying capacity, and reduce outages in protected or unprotected sections. Later, when more functions are wanted, additional G-E apparatus is designed to fit quickly and easily into your original installation.

Literally "packaged" G-E carrier-current equipment can be added as needed for every purpose, if you insist on modern G-E equipment from the start.

Here are some major carrier-current functions that may boost the kilowatt-hour output of your system:

1. Pilot relaying
2. Transferred tripping
3. Automatic tie-line load control
4. Telemetering
5. Telephony
6. Supervisory control
7. Line sectionalizing control

G.E. has led the field in carrier-current design, research and application for 20 years, and its installations cover the nation. Your G-E representative will gladly discuss with you the application of carrier current to your system. . . . *Electronics Department, General Electric, Schenectady, N. Y.*

Tune in "THE WORLD TODAY" and hear the news direct from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. . . . On Sunday listen to "The Hour of Charm" at 10 P. M. E.W.T. over NBC.

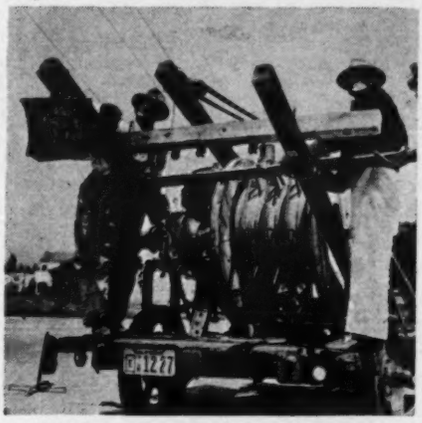
Transmitter-receiver assembly mounted on same column that supports the coupling capacitor: base also includes line tuning equipment and a potential device.

GENERAL ELECTRIC

151-84

4-Wire Take-Up Reel Cuts Labor Costs

By rigging up a special take-up reel the Los Angeles Bureau of Power & Light was able to remove an old eight-wire telephone line in one-third the time that otherwise would have been required. In addition to saving time of men and equipment, an incidental but important good-will objective also was attained.



SPACE-BOLT SPOKES and rubber hose were used to divide this take-up reel into four sections so that four wires at a time could be reeled in

Standard practice would have been to remove one wire at a time, necessitating eight trips by linemen through the backyards of residences crossed by the communication circuits. By pulling four at a time only two trips had to be made. With a Victory garden in almost every backyard, eight treks by linemen through carefully nurtured gardens would have been cause for concern and wonderment by property owners.

The idea for a rig to do four operations in one originated with Harry L. Brenzikofer, superintendent of Overhead District No. 6, and was executed with the help of Lloyd Steele, assistant superintendent, and line foreman of the district.

A standard power driven take-up reel was divided into four sections by separators formed by attaching ⅝-in. space-bolts like spokes to the axle of the reel. To guide the wires into their respective sections ends of the bolts were connected by lengths of ¾-in. insulating hose, stiffened by round pieces of wood.

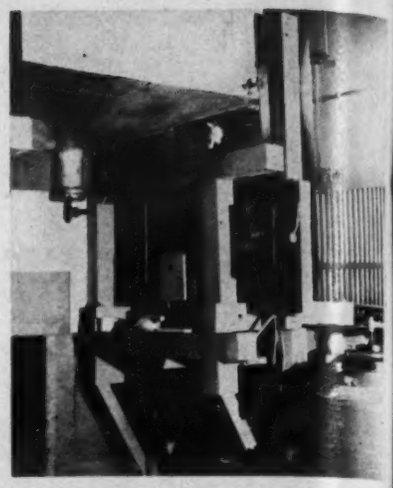
A guide assembly consisting of a crossarm and insulators was added to the frame by foreman F. E. Dlugosh and his crew. They reported that the "four-in-one" system worked fine. Approximately 6 miles of No. 10 bare copper telephone wire was salvaged, representing 11,500 lb. of valuable metal. It was replaced by a 25-pair cable in some sections and a 50-pair in others, to relieve traffic congestion on the former four circuits serving the West Los Angeles business of the department. Some of the new circuits will be used for electrical control purposes by distributing stations in the west part of the city.

•

Oil Reclaiming System Developed

Montana Power Company at its Montana Street substation and shop has an oil reclaiming system in which all oil from high-tension transformers throughout the system is purified. The plant contains a number of features which are novel and were designed and built by the company. Outside of the building housing the equipment are four 7,000-gal. tanks, the capacity being sufficient so that the plant need be operated only about one-third of the time to keep up with the oil-cleaning requirements.

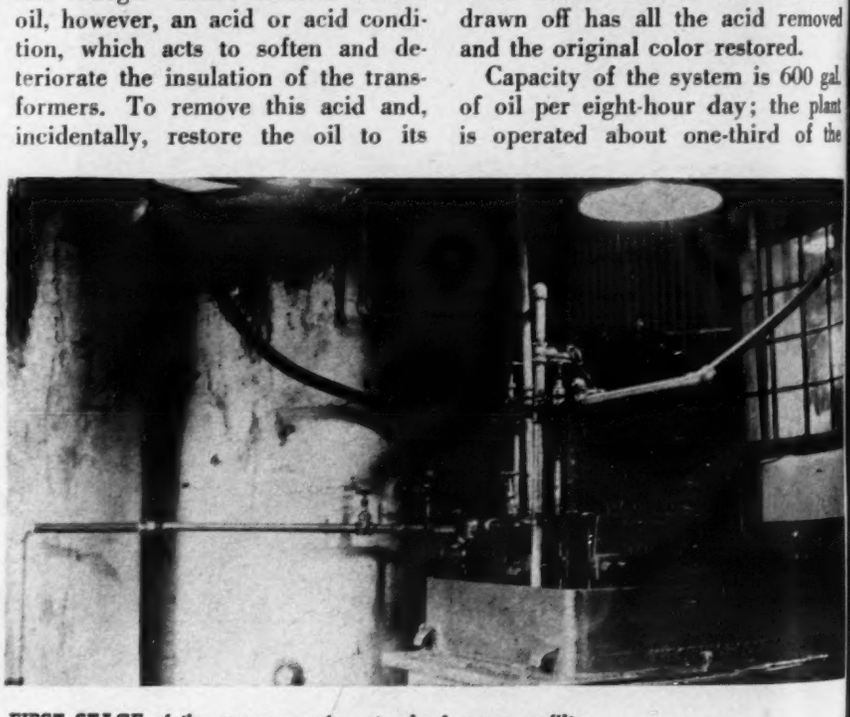
From the outside tanks the oil is pumped into three 14-barrel tanks inside the building, from which it is passed through a standard Westinghouse filter press to remove water and sludge. There remains in the oil, however, an acid or acid condition, which acts to soften and deteriorate the insulation of the transformers. To remove this acid and, incidentally, restore the oil to its natural color, another step has been inserted.



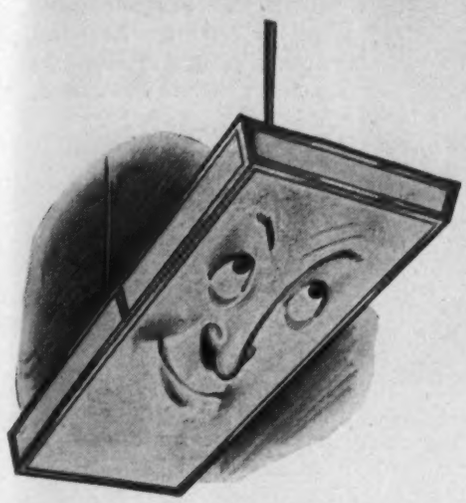
TALL TANK for containing oil after it has been passed through pressure filter and before entering fuller's earth filter at rear left. At upper left is square tank for storing crankcase oil, which is also cleaned by passing through the fuller's earth filters

From the filter press the oil is pumped into a vertical tank, which is about 10 ft. high by 3 ft. in diameter. From this tank the oil feeds by gravity into four filters connected in parallel with the tank. These filters, as seen in the illustration, are old lightning arrester tanks adapted to the purpose. Inside of each is a removable casing of a size to contain 150 lb. of fuller's earth. The oil is fed on top of the earth and seeps down through it to openings provided in the bottom. The oil when drawn off has all the acid removed and the original color restored.

Capacity of the system is 600 gal. of oil per eight-hour day; the plant is operated about one-third of the



FIRST STAGE of the process, using standard pressure filter



Wonder what a Fluorescent Fixture thinks about?

Wonder what will happen to us fluorescent fixtures hen the war is over? Wonder if a lot of us won't be ck numbers with all the new stuff that is coming ong?"

* * *

hen the lights come on again there are going to be anges in fluorescent fixtures and in fluorescent light- g. Right now no one can tell just what these new tures will be like or whether light sources will be ferent . . . but of these things you can be sure:

. Most Present Fluorescent Fixtures will be Obsolete

st-war fixtures will be less bulky, lighter in weight, sier to install and maintain. They will be made of fferent, new materials—laminated and impregnated ood, lignin and laminated-lignin, paper plastics, nthetics and treated asbestos. Special new types of ass, magnesium alloyed steel and aluminum will also used.

xtures of these new materials may easily be stronger, ve better reflection factors, and stand up better under oist and corrosive atmospheres than pre-war fixtures d. New production methods learned during wartime ould result in lower fixture prices. New designs may rmit closer mounting to the ceiling . . . may permit sh-to-ceiling mounting.

2. Post-war Demand for Fluorescent Lighting will be Tremendous

ready there exists an unfilled demand for fluorescent hting and the demand is constantly growing. There many, many store, bank, office, and restaurant ners who would install fluorescent lighting today if they could get the necessary priorities. Add to their number those many people now enjoying fluorescent lighting in war plants who will return to their peace-time shops and businesses after the war. All these people will demand that they be sold fluorescent lighting. And they'll get it . . . even better lighting than they had in the war plants. Better because color quality of the light will be improved. Starters will be better. Fixtures will be made in smart, new designs tailored to every lighting purpose.

3. No Helter-skelter Selling of Fluorescent Lighting

No one knows just when the war will end, but of this we can be certain. *The moment priorities are lifted, lighting is one thing that can be sold almost immediately.* To be sure that *good* lighting is sold, local leadership is needed, leaders who have made plans for a brighter and better tomorrow. Doesn't this leadership rest with the public utility companies?

G-E MAZDA LAMPS

GENERAL ELECTRIC

Hear the General Electric radio programs: "The Hour of Charm", Sunday, 10 p. m. EWT, NBC; "The World Today", News, weekdays, 6:45 p.m., EWT, CBS.

GENERAL ELECTRIC EMPLOYEES ARE NOW BUYING $1,000,000 WORTH OF WAR BONDS EVERY WEEK ★

FULLER'S EARTH filters made of old lightning arrester tanks. Inside are casings capable of holding 150 lb. of fuller's earth, through which the oil is filtered and which takes out the acid and leaves the oil of the original color

time. The fuller's earth is removed from the tanks each day of operation, a small crane lifting the casings out, which are dumped to a truck alongside. So far no use has been found for it and it would be uneconomical to try to clean the earth. The company did try out the oily substance to allay dust on the roadways about the plant, but with every rain the surface became as slippery as glass and would spin truck and car wheels on the level.

The 600 lb. of fuller's earth required per day of operation costs in the neighborhood of $9. But the cost of this operation in addition to the filter press is deemed justified in the operation of the transformers with the purified oil. Once a year the oil in all the high-tension transformers is checked. Samples are sent in to the oil reclaiming plant and tested for acid and dielectric loss. According to the results of these tests the transformers over the system are marked for oil change on a schedule.

This process of using the fuller's earth has been used for a period of about 15 years, the oil being used over and over and losses, only, being made up by new oil. In that period there has been noted marked improvement in transformers from the standpoint of insulation deterioration.

Another feature should be mentioned in connection with this plant. All crank case oil from the company's trucks is run through the fuller's earth filters. This oil is stored in a square tank (see illustration) until there is enough for a run. It comes out of the filters perfectly clear and in excellent condition for use in the crank cases and is used over and over up to the point of breakdown of the lubricant.

This plant, when in operation, is in charge of R. A. Gribble, electrician, in the maintenance shop adjoining.

•

Reinforce Concrete With Steel Guy Wire

Use of scrap steel guy wire as a partial substitute for regular steel reinforcing bars in concrete beams and slabs has been investigated by the electric distribution department of the Wisconsin Electric Power Company.

Based on tests of these beams, it is planned to substitute scrap guy wire for new reinforcing steel to a limited extent in certain manhole roofs. This will avoid purchasing new steel and make good use of old guy wire which would otherwise be junked.

Test beams 6 ft. long, 12 in. wide and 6 in. deep with equivalent steel areas were made up. Three beams contained eight $\frac{5}{16}$-in. guy wires each; three beams contained six $\frac{3}{8}$-in. guy wires each and three beams contained two $\frac{5}{8}$-in. round, corrugated steel rods each. Surface of reinforcement was 1 in., from bottom of beams. Three thousand pound, Hi-early concrete, cured in air for seven days, was used. Beams were tested by applying load at midpoint between supports on 5-ft. centers. The beams were tested at Marquette University under the direction of Prof. O. N. Olson.

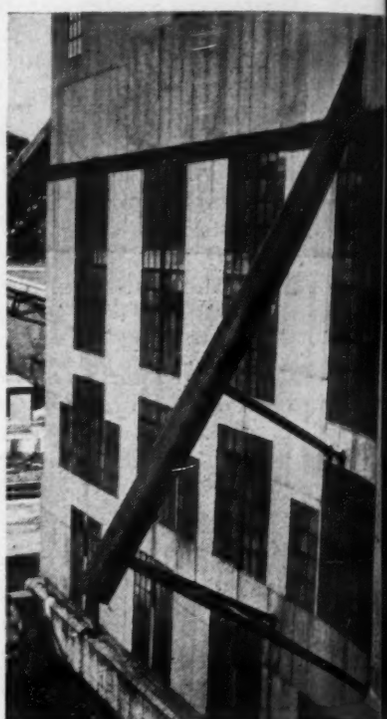
Beams containing the eight $\frac{5}{16}$-in. guy wires failed at an average load of 12,193 lb. Those containing the six $\frac{3}{8}$-in. guy wires failed at an average load of 11,837 lb., while those containing the two $\frac{5}{8}$-in. corrugated rods failed at an average load of 10,493 lb. All beams failed by crushing the concrete. Examination of the broken beams revealed that no slippage of the steel occurred.

•

Downspout for Diversion

An Eastern utility plant supplying process and heating steam to industries adjacent to the station from a boiler bank separated from the main generating units installed a downspout from the bunker compartment to deliver coal to a stockpile in the yard from which the heating boilers are supplied. The downspout was made of No. 14 gage sheet iron welded to a lower wearing surface composed of a 20-in. standard I-beam salvaged from an old bridge, steel being at a premium on the property under war conditions.

Carried through the station wall at an angle of about 60 deg. the spout is braced by two frames made up of 4x6-in. angles as shown. The company is considering adding a so-called "elephant's trunk" discharge pipe at the lower end of the spout to reduce the amount of coal dust in the yard and provide for a more satisfactory distribution of fuel at the stockpile. The inside diameter of the spout is about 20 in. and its length about 25 ft.



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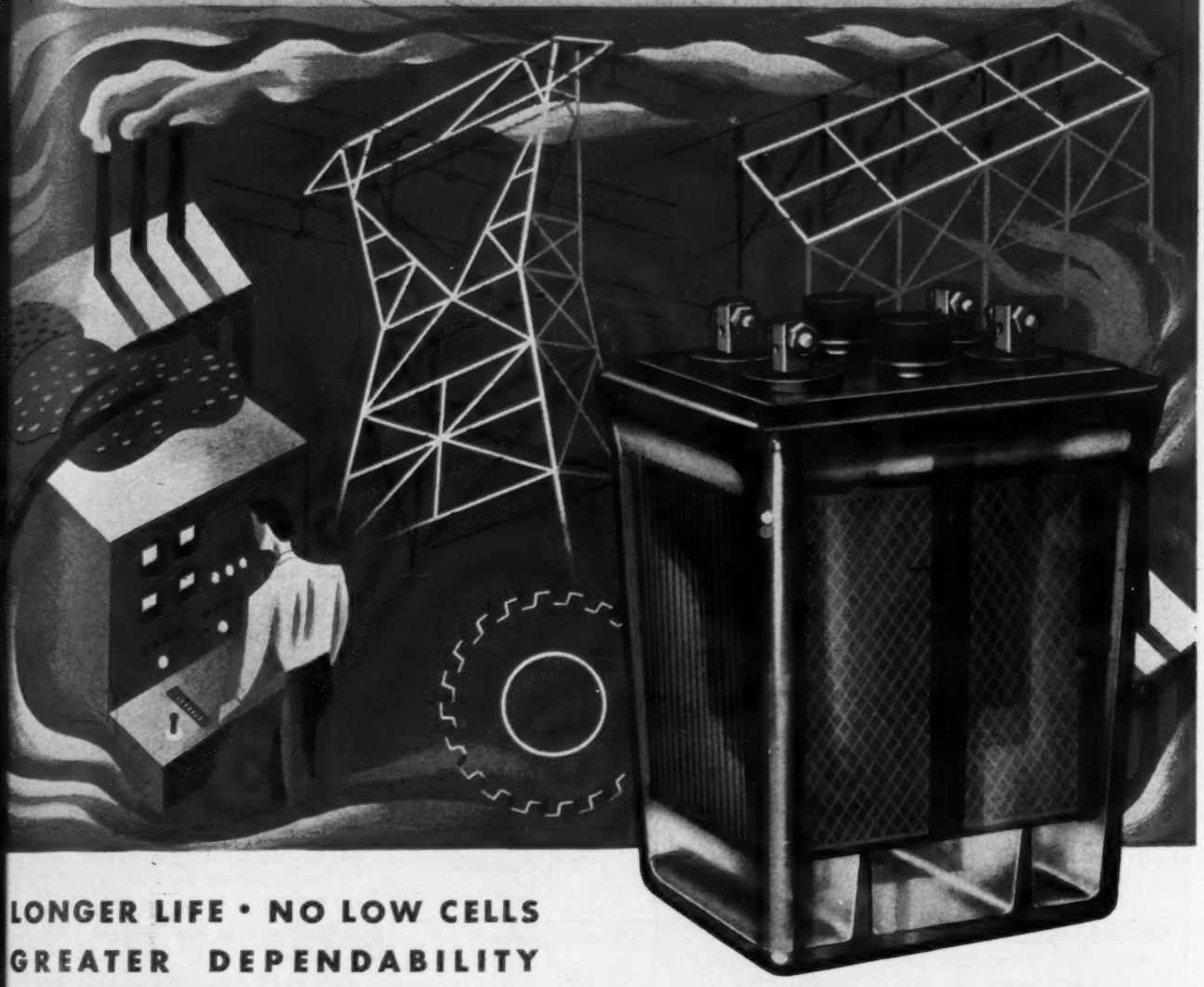

LONGER LIFE • NO LOW CELLS
GREATER DEPENDABILITY

For circuit breaker operation and other stand-by and control installations, Philco Flote' Batteries consistently provide longer life and better all 'round performance. Philco Flote' is the only battery specifically engineered for modern full float service.

Philco Flote' grids are cast in a special Flote' metal which reduces *by 40%* the amount of current required to keep the battery fully charged! Not only is this an important saving in operating costs, but low current consumption materially lengthens the life of the cell! Philco grids are strong and extra thick, designed to retard peroxidation by exposing a minimum of grid surface.

For complete details of Philco Flote' engineering features and specifications, write for the new Philco Control and Auxiliary Power Battery catalog.

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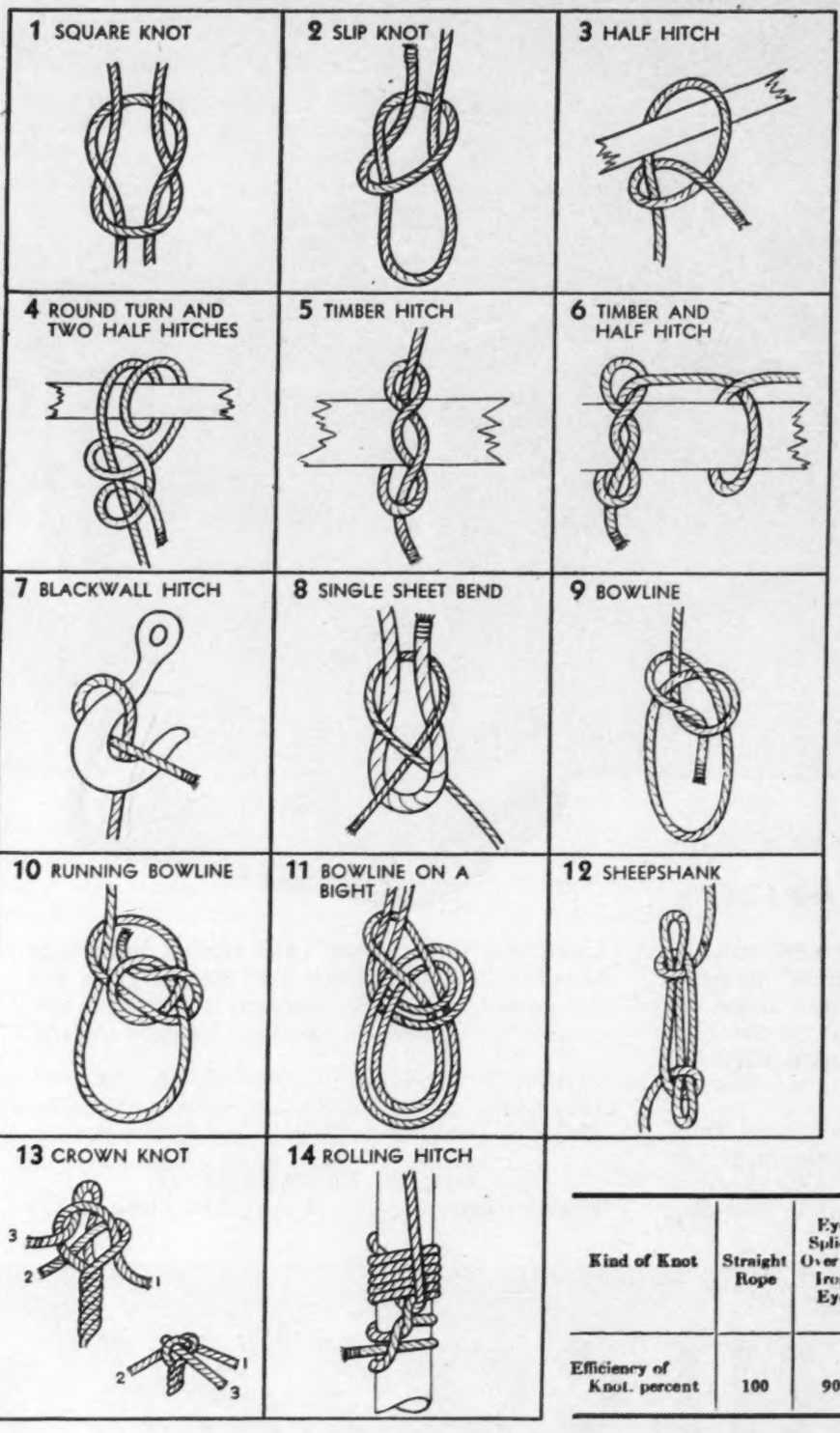
Replace with **PHILCO** *Control Batteries*

ROPE KNOTS

14 KINDS AND THEIR USES*

Make-up and most appropriate application of the more common knots in which line construction men are interested.



1. **Square Knot**—For tying sling ropes, etc., wherever an ordinary knot is required.
2. **Slip Knot**—For hoisting tools and materials to top of pole.
3. **Half Hitch** — For temporary tie to arms, poles, etc., and as an additional knot for raising long material to top of pole.
4. **Round Turn and Two Half Hitches**—For fastening to objects where rope is at an angle and may slide upward or downward.
5 and 6. **Timber Hitch and Timber and Half Hitch**—For pulling and raising poles.
7. **Blackwall Hitch**—Fastening to hook where under a steady strain.
8. **Single Sheet Bend**—Joining two ropes of different sizes temporarily.
9. **Bowline** — General purpose knot for fairly heavy strains.
10. **Running Bowline** — For fastening to top of poles when temporarily guyed. Used in place of slip knot for heavy strains.
11. **Bowline on a Bight** — Used where fastening must be made somewhere in rope away from the end.
12. **Sheepshank**—For shortening the length of rope.
13. **Crown Knot**—To finish off end of rope and keep it from unraveling.
14. **Rolling Hitch**—For pulling wires and heavy strains parallel to object being pulled.

When knots are tied in rope it is weakened due to the bending of the rope which places most of the strain on the outer fibers. The knot which had the least weakening effect is the one that requires the least abrupt bending. The accompanying table shows the approximate percentage of strength left in a rope after one of the class of knots has been placed in it. Other knots can be estimated by comparing them with those listed.

Kind of Knot	Straight Rope	Eye Splice Over an Iron Eye	Short Splice	Timber Hitch Anchor Bind	Clove Hitch Running Bowline	Square Knot	Overhand Knot
Efficiency of Knot, percent	100	90	80	65	60	50	45

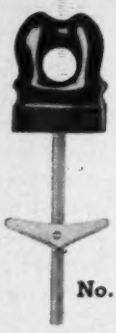
Adapted from *The Line*, July-August, 1943, issued by Line Material Company, Milwaukee, Wis.

OLIVER WIREHOLDERS

No. 2636

No. 2600

No. 2700



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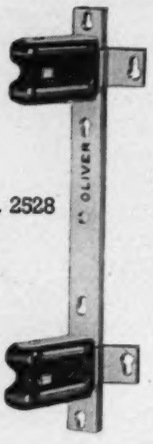


No. 2510

Built for FAST DRIVING and LONG LIFE

Strength and safety mean satisfaction for you when you standardize on OLIVER Wireholders. Designed and built to meet your day-by-day problems, Oliver line includes styles and sizes for various service conditions and mounting requirements. Typical Oliver Wireholders are illustrated here.

Practical advantages of the style shown above includes: strong, one-piece base; sharp wood screw; safety lock rigidly holds screw in place; firm, even seat; ample strength for "slamming-in"; porcelain used in compression—metal parts in tension.

Let your OLIVER Jobber show you the complete line.

OLIVER
IRON AND STEEL
Corporation

Makers of Pole Line Materials Since 1894
PITTSBURGH, PENNSYLVANIA

Self-Clearing Gaps Reduce Service Calls

By W. L. MANTON
Manager Georgia Electric Membership Corporation, Dalton

North Georgia Electric Membership Corporation is supplying more than 6,000 customers, mostly farms, with electrical energy. The energy is distributed by means of a 6,900/11,937-volt, three-phase, 60-cycle, four-wire grounded neutral system, with approximately three thousand 6,900-volt rural type distribution transformers.

The original system was designed and installed on the basis of protecting the individual transformers by means of plain rod gaps mounted on the high-voltage transformer bushing. This type of gap, when properly adjusted, will reduce lightning voltages to a value well below the impulse strength of the transformer winding,

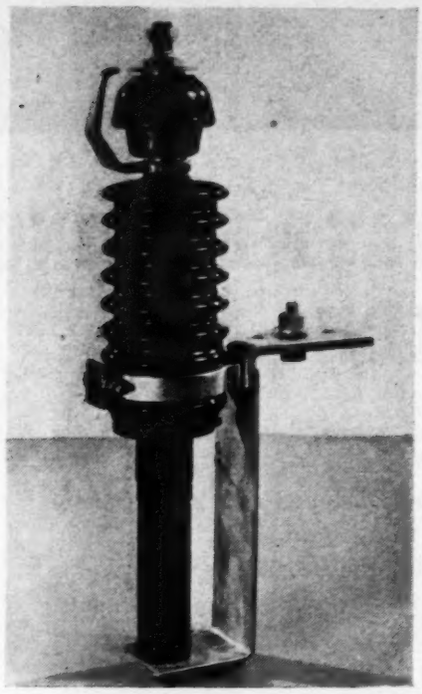


FIG. 1—Type T De-ion gaps on 6.9-kv. rural line reduce service calls and breaker operations

but has the obvious disadvantage that the gap will continue to arc until the substation breaker opens for a sufficiently long period of time to permit the arc to go out. Therefore, in order to reduce the service interruptions to a minimum, the substation breakers were provided with automatic reclosing relays, arranged for instantaneous trip and reclosing (approximately 60 cycles) on the first

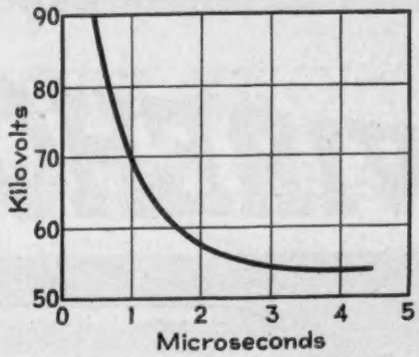


FIG. 2—Discharge time-lag curve of 6.9-kv. self-clearing gap on positive 1½-40-microsecond wave

operation and with time-delay trip on the second and third operation. This arrangement, therefore, necessitated a breaker operation for every gap or line flashover, caused by either lightning, line surges or birds bridging the transformer gap. In case the fault was of a permanent or semi-permanent nature, a second or third breaker operation and service interruption of a somewhat longer duration was required in order to permit time for the branch or transformer fuse to clear and isolate the fault.

After one year's operation with this system it was quite apparent that some modification was required in order to decrease the number of breaker operations and reduce the expense of service calls. A study of the records indicates a total of 3,500 breaker operations and during a 60-day period, during April and May, a total of 217 service interruptions were experienced, requiring 200 line or transformer fuse replacements.

In order to correct this condition a limited number of trial installations were made, using gap electrode shields and a double gap arrangement. It was, however, at once apparent that this would not offer sufficient improvement. A trial installation was therefore made on a complete section of line, replacing all plain gaps with Westinghouse type T De-ion gaps. The results of this installation were immediately favorable. The De-ion gap has excellent protective qualities and, since it is self-clearing on flashovers, it does not cause a breaker operation.

We have now installed more than 1,500 De-ion gaps, which, together with the installation of a third breaker, have resulted in reducing the number of service calls to less than one-fifth and the number of breaker operations to less than one-fourth.

Installation of the De-ion gap is relatively simple and inexpensive since the gap is completely self-contained, with insulated series line gap and current-limiting resistor. It can be bolted directly to the transformer tank and requires no electrode adjustment of any kind. Our experience indicates that although the De-ion gap has a somewhat higher initial cost than a plain gap, the difference in cost is small in comparison to the cost of a single service call and can be readily justified by providing complete relief from bird flashover troubles, and by decreasing the number of breaker operations and service interruptions.

The total cost of changeover has been more than paid for; of equal importance is the fact that we have been able to improve the quality of service to our customers and have rendered this improved service with a similar number of man-hours and with a considerable saving in the use of gasoline and tires.

•

How a Centrifuge Purifies Oil

By HOBART E. ROWE
University City, Mo.

Fundamental characteristics of a centrifuge as an oil purifier are outlined here. The centrifuge separates from oil those contaminants which have a different density than oil. This is accomplished by the application of a separating force equal to several thousand times that of gravity.

A centrifugal type purifier accomplishes the following:

1. It separates free water from the oil and is the most convenient equipment known for that operation.

2. It will separate oil and water mixed in any proportions.

3. It will remove dirt, coarse sludge, from oil.

A centrifuge has the following limitations:

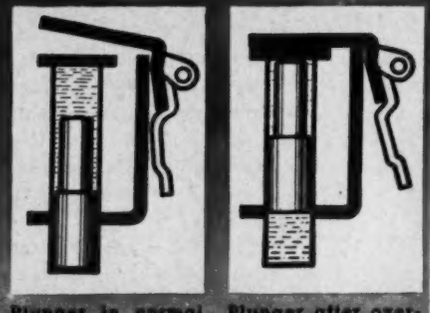
1. It will not appreciably remove colloidal carbon and fine sludge.

2. It does not remove organic acids or water dissolved in the oil or appreciably increase resistance to emulsification.

3. Power for operating the equipment must generally be secured from a tap connected to the high-voltage line in the substation.

Characteristics of the blotter filter

"Inside" Dope on HEINEMANN MAGNETIC CIRCUIT BREAKERS



Plunger in normal position at bottom of cylinder.

Plunger after overload with armature attracted to pole piece, opening contacts.

TIME DELAY ON OVERLOADS . . . .

The magnet coil surrounds a hermetically sealed and liquid filled cylinder which contains an iron plunger. This plunger, while normally not in the magnetic field, moves into the field on overloads with the liquid controlling the speed at which the plunger moves. The magnetic flux increases as the plunger rises, attaining its maximum when the plunger reaches the top of the cylinder. At this point the trip armature is attracted to the pole piece and operates the latch mechanism which opens the contacts. Various time delays can be obtained by the use of liquids of different viscosities.

INSTANTANEOUS ACTION ON SHORT CIRCUITS . . . .

Short circuit currents energize the pole piece with sufficient speed to attract the armature before the plunger moves.

BLOWOUT ACTION AT CONTACTS . . . .

Magnetic blowout contacts mounted in individual arcing chambers add speed to the arc interruption. As the value of the current to be interrupted increases the quenching effect becomes greater due to the intensified magnetic blowout field.

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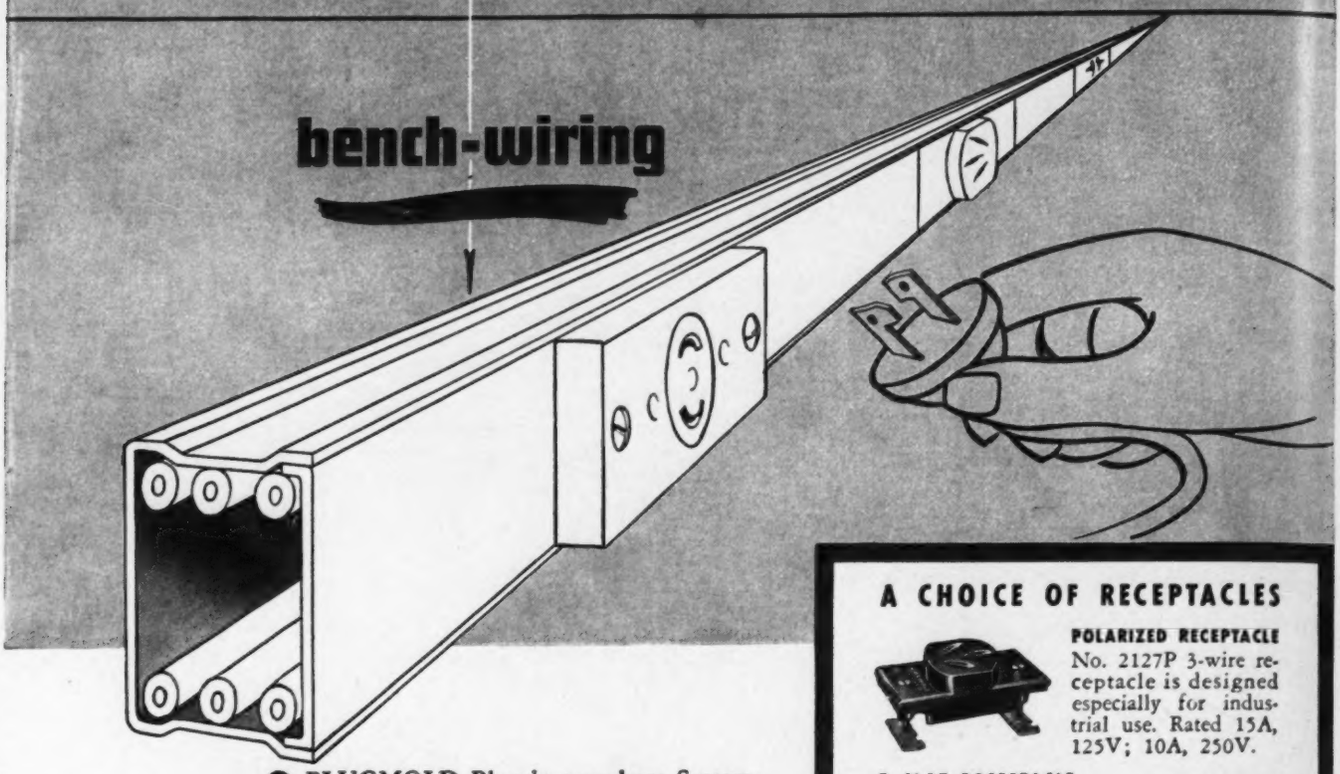

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T-SLOT RECEPTACLE
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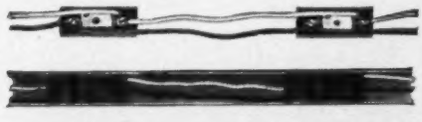

Wire receptacles, insert in channel and snap on cover.

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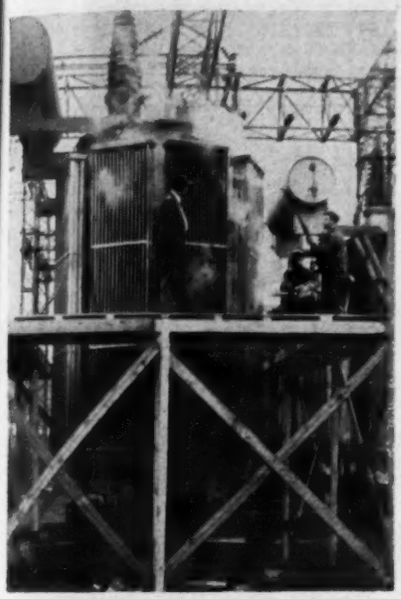
press were outlined in the August 7, 1943, issue of ELECTRICAL WORLD. Similar information on fuller's earth filter and activated alumina will be presented in subsequent issues.

•

Housecleaning Large Power Transformers

By G. T. TWYFORD
Electrical Engineer
Potomac Edison Company, Hagerstown, Md.

Cleaning and painting operations were maintenance problems for four 10,000-kva., 132/66-33-kv., single-phase, 60-cycle transformers installed at the Cumberland plant substation of the Potomac Edison Company. The transformers are conservator type, self-cooled; three are used for a bank and the fourth is a spare.



CLEANING a 10,000-kva. transformer preparatory to maintenance painting

Having had but one bath since 1927, the units required a housecleaning this spring. A small amount of oil had leaked from various gaskets. This oil ran down over the radiators and some parts of the transformer casings; this made an ideal condition for the collection of carbon and dirt from the power plant and the railroad adjacent to the plant.

To clean these large transformers in the normal way of scraping and brushing would have been a difficult job. Representatives of Oakite Products, Inc., recommended that the transformers be cleaned with a solution made by mixing 10 lb. of Oakite No. 20 in a barrel of water and applying it with steam at 75 lb. pressure through a device known as a "solution-lifting steam gun," supplied by the same company. This gun is approximately 5 ft. long and has an insulated handle which can be readily used without possibility of burning the hands from the hot steam pipe of the nozzle.

Due to the height of the transformers it was necessary to build a substantial scaffold, as the barrel of Oakite solution had to be raised to an elevation of approximately 12 ft. because the gun would raise this solution only 10 to 12 ft. The time required to build the scaffold and to do the cleaning job for all four transformers was 150 man-hours.

For corrosion protection of the transformers 20 gal. of paint was used for a one-coat job, except for spot covering using a priming paint. The paint used was Subalox No. 508 manufactured by Subox, Inc., North Arlington, N. J. Time required to paint all four units using a spray gun was 164 man-hours.

The three transformers were removed on Sunday during off-peak load period and the tops of the transformers were cleaned and painted, including about 20 percent of the transformer tank below the cover. The remainder of the transformer tank and radiators were cleaned and painted with the transformers in service. The temporary scaffold was moved from one transformer to another as the work progressed.

This is the first time that this company has used this method of cleaning large power transformers prior to a painting job for maintenance; it has been found to be a very satisfactory method.

•

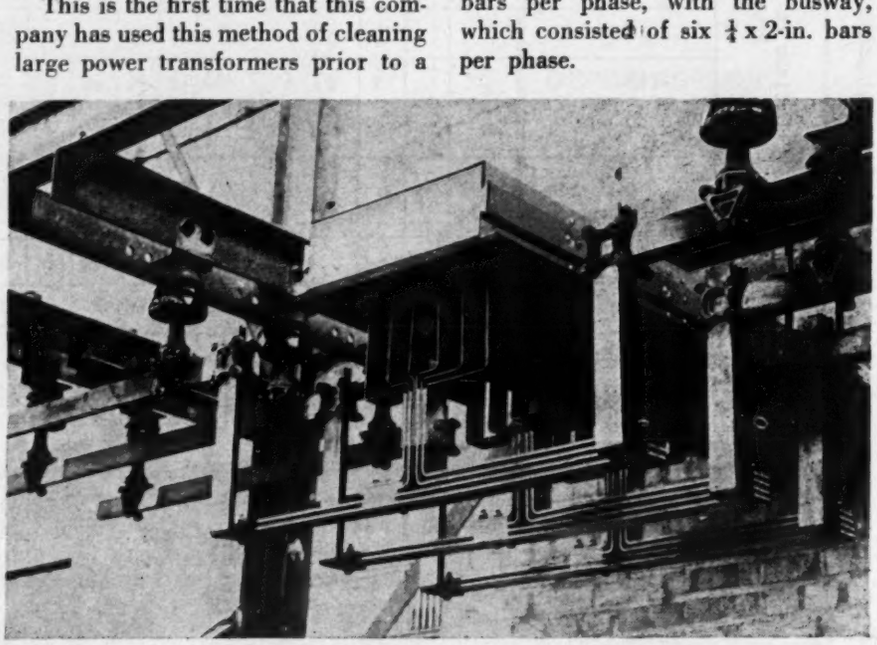
Interfering Buses Skillfully Joined

One method of connecting an open-type 460-volt substation bus with an inclosed run of busway when the two are on the same level is shown in the accompanying illustration showing an installation at the Peshtigo, Wis., plant of the Badger Paper Company.

To take care of increasing load the paper company recently installed new 460-volt air-break switchgear equipment in a new switchgear building. At the same time the Wisconsin Public Service Corporation increased the capacity of its 13,800/460-volt substation serving the plant.

Connection between the external 460-volt substation bus and the new switchgear cubicle was by means of a 12-ft. length of busway that projected through the wall of the switchroom. Circumstances and the rigid, close-fitting construction resulted in the busway emerging from the wall on the same level with the substation bus, complicating the connection.

To make the necessary connection between the open and inclosed bus it was necessary to cut the substation bus as shown and divert it around the inclosed busway. A special busway fitting was used to join the open bus, consisting of four $\frac{1}{4}$ x 2-in. copper bars per phase, with the busway, which consisted of six $\frac{1}{4}$ x 2-in. bars per phase.



DIVERT substation bus around projecting busway type service connection at Wisconsin paper mill

FOR CHECKING WIRING DRAWINGS

By E. R. BONDS, Robert & Company, Inc., Atlanta, Ga.

	Wire Size A.W.G. & 1,000 Cir.mil	18	16	14	12	10	8	6	4	2	1	0	00	000	0000	250	300	400	500	600	750
Amperes Allowed*	600-Volt Conductors																				
	R†	3	6	15	20	25	35	50	70	90	100	125	150	175	225	250	275	325	400	450	525
	RP			18	23	31	41	54	72	96	110	127	145	166	193	213	238	281	319	353	398
	RH			22	27	37	49	65	86	115	131	151	173	199	230	255	283	336	382	422	475
	V			25	29	38	50	68	88	118	138	157	189	209	237	272	299	361	404	453	502
Sizes in Inches of Conduit Required for Designated Number of Wires or Cables in One Conduit	600-Volt Rubber Covered																				
	1	½	½	½	½	½	½	½	½	¾	¾	1	1	1	1¼	1¼	1¼	1½	1½	2	2
	2	½	½	½	½	½	¾	1	1¼	1¼	1½	1½	2	2	2	2½	2½	3	3	3	3½
	3	½	½	½	½	¾	1	1¼	1¼	1¼	1½	2	2	2	2	2½	2½	3	3	3½	3½
	4	½	½	½	¾	¾	1	1¼	1½	1½	2	2	2½	2½	2½	3	3	3½	3½	4	4½
	5	½	½	¾	¾	1	1¼	1½	2	2	2	2½	2½	3	3	3	3½	4	4	4½	5
	6	½	½	¾	1	1	1¼	1½	2	2	2½	2½	3	3	3	3½	3½	4	4½	5	6
	7	½	¾	¾	1	1	1¼	2	2	2½	2½	3	3	3	3½	4	4	4½	5	6	6
	8	½	¾	1	1	1¼	1¼	2	2	2½	3	3	3	3½	3½	4	4½	5	5	6	6
	9	½	¾	1	1¼	1¼	1½	2	2½	2½	3	3	3½	3½	4	4½	4½	5	6	6	
	600-Volt R-LC																				
	3-1C			¾	¾	1	1¼	1½	1½	1½	2	2	2	2½	2½	3	3	3	3½	4	4
	1-2C			½	¾	¾	1	1¼	1¼	1¼	1½	2	2	2	2½						
	1-3C			¾	1	1	1	1¼	1½	1½	2	2	2½	2½	3	3	3½	3½	4		
	5,000-Volt Rubber ‡																				
	3-R-Br						2	2	2	2½	2½	3	3	3	3	3½	3½	4	4	4½	
	1-3C-1C						2	2½	2½	2½	3	3	3	3½	3½	3½	4	4	4½	4½	

* See Code for reductions in these values if more than three conductors are contained in one conduit.

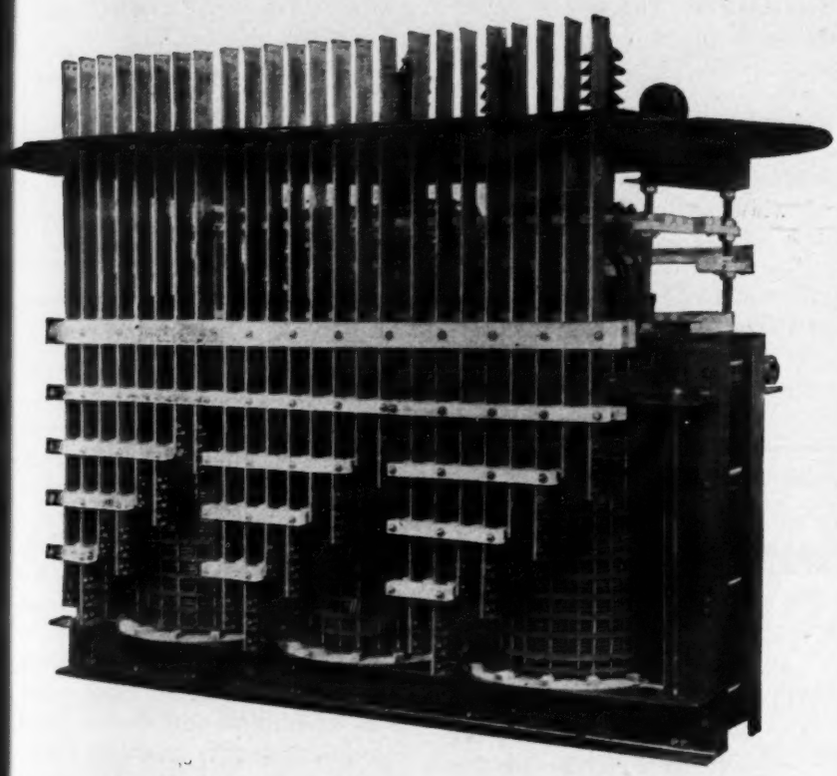
† Values in this column taken from Interim Amendments to the 1940 National Electrical Code.

‡ Calculated values, not taken from Code.

When bills of material are written from scale drawings and construction is based on them, errors in the designations of numbers and sizes of wires and conduits cannot be allowed. The drawings must be checked rigorously for certainty that no such errors exist. The checking is at best a tedious job, but it can be facilitated by such a tabulation as appears on this page and which was obtained from the Atlanta office of Robert & Company. In this compilation are combined values of permissible ampere loadings on 600-volt conductors and sizes of conduit required for numbers of conductors up to and including nine as specified in the National Electrical Code. With this tabulation, which is small enough for convenient handling on a desk or drafting board, all usual combinations of wires and conduits can be checked quickly.

FURNACE TRANSFORMER *Facts*

★ The transformer that supplies power to an electric rnace is an extremely complicated unit. The rules overning ordinary designs and construction of Power ansformers do not apply to Furnace Transformers. any special conditions such as overloads, short circuit resses, distribution of currents and reduction of eddy sses must be met by engineering skill and highly erfected workmanship.



ennsylvania Transformer Company has acquired a noted putation in the Furnace Transformer field. For over thirty ars its engineers have closely followed the development of ectric furnaces. They fully understand the problems of Electric rnaces and their relation to Furnace Transformers.

1. OVERLOADS & SHORT CIRCUIT STRESSES

Electric Furnace operation inherently subjects Furnace Transformers to frequent short circuits and heavy overloads. The effect of this on the transformer is complicated by the wide range of voltages which necessitates cutting out large portions of the primary windings. The effects of both the radial and axial short circuit forces are greatly reduced in Pennsylvania Furnace Transformers by the use of Circular Coils and an ingenious winding arrangement.

•

2. BALANCING OF STRESSES

Pennsylvania coils are balanced to reduce the radial and axial short circuit stresses to a minimum. 1. The circular shape protects the coils against deformation due to radial short circuit forces. 2. The total axial short circuit force is calculated for each design and the coils are subjected to an equivalent pressure in a three hundred ton hydraulic press. The ability of the coils to maintain their shape, under the prescribed pressure, guarantees that the transformer will safely withstand short circuits.

•

3. DISTRIBUTION OF CURRENTS

Due to the heavy secondary currents, the winding must be subdivided into numerous parallel sections. A skillful arrangement of the windings insures that each section carries an equal share of the current. Careful transposition of the individual conductors of each section in the windings reduces the copper eddy losses to a minimum. This results in improved efficiency, more uniform copper temperature and prevention of hot spots.

•

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PITTSBURGH, PENNSYLVANIA

Pennsylvania TRANSFORMERS

Right Locations for Step-regulators

By HENRY S. WILLIAMS and MAX W. ROTHPLETZ
Associate Engineers, Technical Standards Division
Rural Electrification Administration

In order to determine the optimum size and location of a step-regulator the loading of the system should be known and the voltages under maximum and minimum loads either be measured or calculated. A map of the system showing important loads, wire sizes and length and phasing of lines will be a big help in deciding on the location of the regulator. Since the size of the regulator to be used depends on the load taken from the lines beyond it, the location must be determined before the size can be calculated. Determination of the proper location of the regulator and any associated equipment can best be demonstrated by an example.

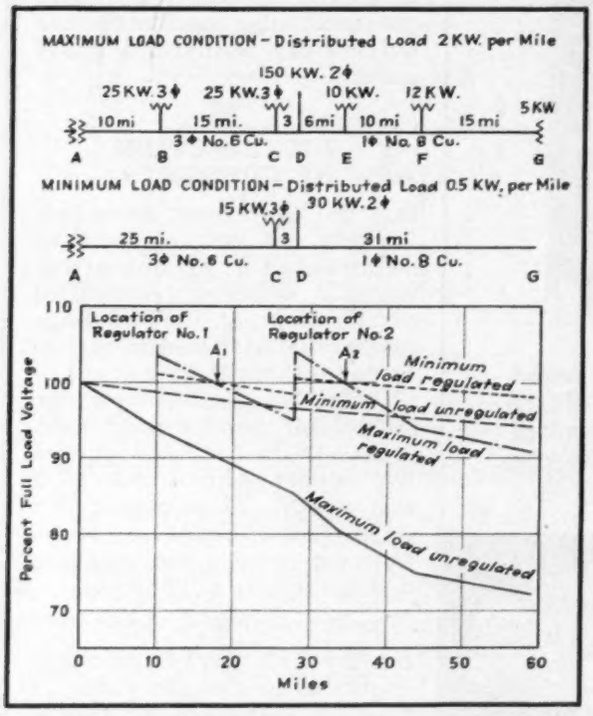
Voltages at various points on the system were calculated for both maximum and minimum load conditions (see accompanying illustration). An examination of the maximum load voltage characteristics indicates that to provide enough voltage correction to maintain the voltage within 10 percent of normal, at least two 10 percent regulators in series are needed.

A number of factors should be considered in deciding on the exact location of the regulators: (1) The maximum voltage at any point on the regulated system should not be high enough to overexcite distribution transformers or burn out lights. There is no general agreement on what the exact maximum allowable value is, but it is probably in the neighborhood of 126 volts on a 120-volt system. (2) The maximum number of consumers should be served at or near 100 percent voltage. (3) Important (large power) loads should preferably be on the high, rather than on the low, voltage side of the regulators.

In the example we have attempted to place the two units in accordance with the above suggestions and with the further assumption that line drop compensators would be used. This arrangement provides that the voltage at points A_1 and A_2 remains 100 percent, except for the variations produced by loads taken from the feeder between these points and the respective regulators. The contact-making voltmeter should be set to maintain 100 percent voltage with as narrow a band width as practicable, possibly as low as plus, or minus 1 percent. The line drop compensators should then be adjusted to maintain 100 percent voltages at points A_1 and A_2; this is accomplished by adjusting the resistance and the reactance to make them proportional to the resistance and reactance of the lines between the regulators and points A_1 and A_2, respectively.

Line drop compensators are not entirely necessary, for the regulators could be set to maintain approximately 104 percent voltage (the peak regulator voltage under maximum load) at the points of installation. Under maximum load conditions the regulated voltage characteristic would be the same as that shown, but the regulated voltage under minimum load would be considerably higher.

This would not be particularly objectionable; however, if the voltage under minimum load had a rising rather than a drooping characteristic, excessively high voltages would be produced during light load periods.



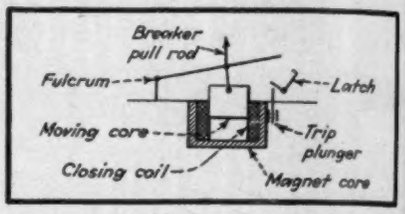
VOLTAGE GRADIENTS point to step-regulator locations on 56-mile, 11-kv. line; loads from 0.5 to 2 kw. per mile

How to Close, Trip Circuit Breakers

2. Closing Methods, Solenoid Mechanism*

By G. J. EASLEY
Switchgear Engineer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

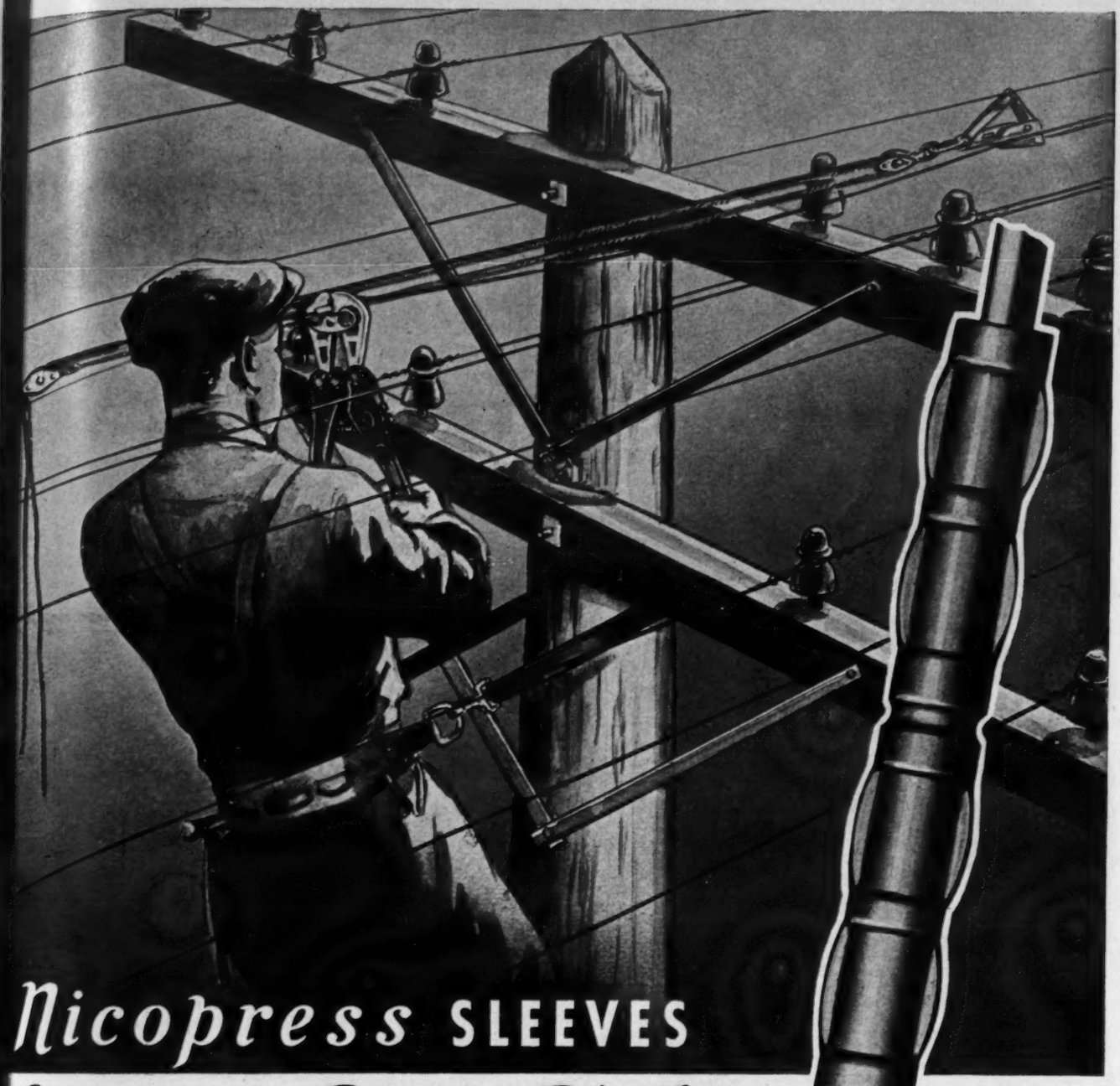
Earliest form of operating mechanism was the d.c. solenoid type, which is still the simplest and most widely used. It is inherently well adapted to circuit-breaker operation since its greatest pull is at the closed position. For conventional breakers this matches the breaker load characteristics which are also greatest at the closed position. The earliest solenoid mechanisms were not mechanically trip-free. They consisted only of a solenoid connected to a single lever, hinged at one end and latched at the other, as shown in the accompanying illustration.



SCHEMATIC DRAWING of non-trip-free solenoid

The solenoid mechanism, on breakers above the contactor class in size, is an intermittent duty device. It has a highly inductive magnetic circuit. Therefore, in order to get a reasonable rate of current rise it is necessary to provide the required ampere-turns through use of a small number of turns and a high current. The rate of current rise is proportional to the ratio of L/R where L and R are the inductance and resistance of the coil respectively. Carried further, it is proportional to N^2/R, where N is the number of turns on the coil. The speed of closing is, of course, dependent on the rate of current rise. Even

*Second in a series of twelve articles which began in the July 10, 1943, issue of "Electrical World."



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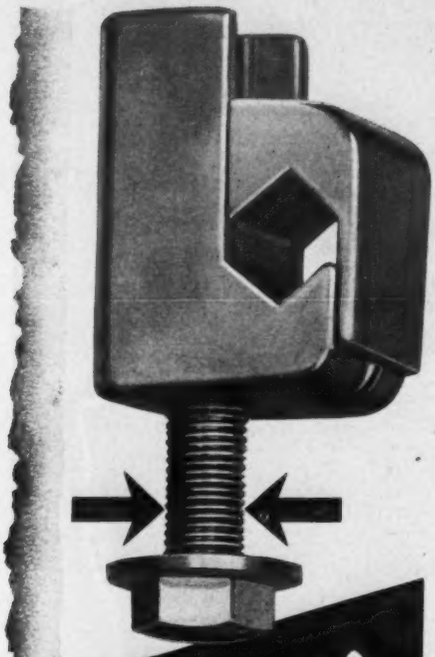

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if a fast coil with a small number of turns is used the current never reaches its full E/R value (where E is the d.c. supply voltage and R is the coil resistance) before the breaker closes and the closing coil is automatically cut off.

Closing Coil Operation

Behavior of the closing coil current under operating conditions is shown in Fig. 2 (ELECTRICAL WORLD, August 7, 1943, page 84). The breaker does not move until current has built up enough to supply the necessary pull. The current continues to build up during the closing stroke, but presently begins to decrease since the inductance of the magnetic circuit increases as the magnet-gap closes. The current starts to build up again at the end of the magnet-core movement before it is finally cut off by the Y contactor. The Y contactor is energized before the closed position is reached. However, it is designed to be slow so that several cycles elapse before closing power is removed. It will be noted that the maximum current reached is 115 amp.; this is 85 percent of the E/R value of 136 amp.

Closing speed of a solenoid mechanism is critically affected by the control voltage. Closing time, measured by the manufacturer, is determined with normal voltage at the closing coil terminals and with full closing-coil current flowing. In the field installation the closing time will be slower if control voltage is below normal.

A.c. solenoid mechanisms have been found satisfactory only for small units such as contactors. When tried on large size breakers they were extremely noisy and had poor pull characteristics in the closed position.

High-Speed Relaying

The non-mechanically trip-free device was satisfactory until high-speed relaying came into the picture. If the breaker happens to close on a short circuit and is tripped immediately by high-speed overload relays the breaker will open sluggishly due to the drag of the solenoid. If the overload relays have at least ¼ to ½ second time delay, depending on the size of the solenoid, the magnetic flux of the solenoid will have time to die down to a value which will not be a drag on breaker opening. However, modern relaying schemes are usually faster than this and require the use of mechanically trip-free solenoid mechanisms.

•

Special Torch Tip for Lead Burning

Lead burning is being used by the Cincinnati Gas & Electric Company to repair incidental sheath damage and make duct splices in lead-sheathed power cable reclaimed on the system.

As a result of experience to date with lead burning, men engaged in this work use an oxyacetylene torch

EXTREMELY fine oxyacetylene flame desirable in cable sheath repair by lead burning is made by heating and drawing out ⅛-in. O. D. copper tube

tip of their own making which gives a much sharper and finer flame than any available on the market. The tip is made from a 9-in. length of ⅛-in. O. D. copper tube with $\frac{1}{16}$-in. bore. A section of tube is heated and drawn out, under tension, until it necks down. The tube is then cut at the neck, yielding a tip with a hole but little larger than a pin point.

After the end of the tube is given a slight bend, to simulate the angle of a torch tip, it is wrapped with asbestos and friction tape to form a handle. The un-necked end of the tube is then inserted in a small diameter rubber tube ending in a rubber sleeve that slips over the tip of a conventional welding torch. Needle valves of the conventional welding torch are used to adjust the flame. Best oxyacetylene mixture has been

Millions

now in daily use . . .

• Yes, MILLIONS of electric refrigerators, not to mention oil burners and other fractional-horsepower electric appliances with capacitor-type motors, are equipped with Aerovox capacitors • Aerovox pioneered the high-capacitance electrolytic capacitor for motor-starting. Working in closest collaboration with motor designers and manufacturers, Aerovox produced the major portion of all such capacitors in daily use. And Aerovox is maintaining the outstanding selection of replacement capacitors whereby those capacitor-type motors are kept going in wartime America • Electrolytics are but one of many major types of capacitors developed and produced by Aerovox. Aerovox oil-filled capacitor types now functioning in wartime military equipment, will be available for your post-war power-factor correction job. Likewise with mica, paper and other Aerovox types. Just keep AEROVOX in mind.

• Submit your capacitance problems for engineering collaboration, specifications, quotations.

AEROVOX *Capacitors*

INDIVIDUALLY TESTED

AEROVOX CORPORATION, NEW BEDFORD, MASS., U. S. A. • SALES OFFICES IN ALL PRINCIPAL CITIES
Export: 100 VARICK ST., N. Y. C. • Cable 'ARLAB' • In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.

SCR-299
VANGUARD OF INVASION!

THE SCR-299 Mobile Radio Communications unit played a great part in the invasion of Africa and Sicily . . . these units were used as mobile radio stations, transmitting voice commands to fast moving armored units while in action, or as permanent radio stations . . . even under the most difficult operating conditions.

A leading military authority said, "My observations in the theatres of war make it possible to say that the SCR-299 hit the jack pot in the mobile radio field as has the jeep in transportation."

BUY MORE BONDS!

the hallicrafters co.
CHICAGO, U.S.A.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF SHORT WAVE RADIO COMMUNICATIONS EQUIPMENT

found to be 8 lb. oxygen and 8 lb acetylene. Accompanying picture shows an operator making a cable sheath repair by lead burning using the miniature torch.

Filler metal used in the lead-burning operation is $\frac{1}{16}$-in. square strip cut from sheet lead on a conventional metal shear equipped with special stops to give the desired thickness of strip. Fresh strips are cut daily because oxidation of strips more than a day old contributes to the formation of pits in the lead-burned surface.

•

Protect Operator During Oil Tests

For safety reasons, two series switches have been installed in the 110-volt circuit supplying the test apparatus used in making high-voltage dielectric breakdown tests of in-

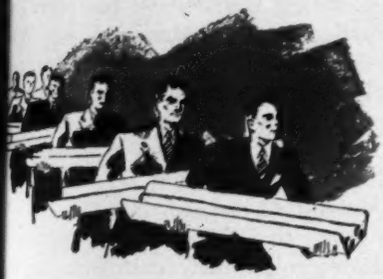
OPERATOR must use both hands to close series switches energizing high-voltage test equipment

sulating oil at the Rivermines substation of the Union Electric Company of Missouri. In order to energize the tester, the operator must step away from the apparatus and use both hands to close and hold the supply switches closed. Thus he cannot, without abnormal effort, come in contact with high-voltage parts. As long as potential is applied to the equipment a lamp in the supply circuit above the equipment remains lighted, warning others in the room of the danger. This lamp may be seen lighted in the accompanying picture.

"When it comes to warplant lighting . . . this label tells me what I want to know!"

Certified
FLEUR-O-LIER
The Manufacturer guarantees by affixing this label that this Fluorescent Luminaire is a duplicate of samples found by periodic examination to comply with the minimum requirements as set up in the
"SPECIFICATIONS FOR LUMINAIRES, FITTINGS AND AUXILIARIES FOR FLUORESCENT LAMPS"
which are sponsored by the Manufacturers of Mazda Lamps.
Electrical Testing Laboratories, Inc.
NEW YORK, N. Y. 8-43
A COPY OF THIS CERTIFICATE SHOULD APPEAR UPON EACH UNIT OR PACKAGE
E·T·L
E·T·L
FLUORESCENT LIGHTING FIXTURES EMPLOYING EXISTING TYPES OF LAMPS ARE NOT RECOMMENDED FOR SCHOOLS, OFFICES AND SIMILAR LOCATIONS UNLESS LAMPS ARE SHIELDED FROM DIRECT VIEW

saves a score of questions. It saves more cores of manhours and money in maintenance. And it can save production eadaches. Because this label on a fluoescent lighting fixture means it's a LEUR-O-LIER . . . TESTED—CERTIIED—GUARANTEED!



5 leading fixture makers participate in the LEUR-O-LIER program . . . build their ixtures to rigid standards set up by Mazda lamp experts. Every single part f a FLEUR-O-LIER is tested to those tandards, and Certified by impartial experts—Electrical Testing Laboratories, nc., of New York—at the beginning.

Then checks are made at quarterly intervals by an E. T. L. inspector who visits the factory of each participant.

Starters and ballasts have their own Certification tests to make sure you get high power factor and reliable operation. The result? You don't have to test either the whole or any part of a FLEUR-O-LIER again. The LABEL tells you it's *right.*

FLEUR-O-LIERS conform to all WPB conservation orders. They're available only with suitable priority rating. Whenever warplant fluorescent is indicated, be sure to specify fixtures bearing the FLEUR-O-LIER label.

Write NOW for new booklet containing complete FLEUR-O-LIER engineering specifications. You'll want them for ready reference when you specify lighting equipment. With them you'll get the FLEUR-O-LIER story and list of manufacturers. Address FLEUR-O-LIER MANUFACTURERS, 2126-8 Keith Building, Cleveland 15, Ohio.

FLEUR-O-LIERS

CERTIFIED FIXTURES FOR FLUORESCENT LIGHTING

Participation in the FLEUR-O-LIER MANUFACTURERS' program is open to any manufacturer who complies with FLEUR-O-LIER requirements

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Customer Service Plan Shows Results

By W. B. FARNSWORTH

Manager, Customer Service Division, Georgia Power Company

Acting on the principle that if the utility looks after residential business now residential business will look after the utility in the uncertain post-war period, the Georgia Power Company put into operation a "customer service plan" in January this year. The plan includes attention to commercial and industrial business, but its greatest emphasis is on residential service. Of course, customer service is not a new thing in the company. As in other utilties, it has been carried on for years in the work of home service representatives, sales personnel, local and district managers and many others. The plan is simply an enlargement of the activities of these groups designed to forestall load mortality for the duration.

Representatives' Duties

Fifty-four former merchandise salesmen were given an intensive course of training as customer service representatives. They are combination salesmen, repairmen, lighting, power and rural engineers, territorial representatives and public relations agents. In homes they help plan better lighting, show customers how to use and care for their appliances properly, make minor repairs and arrange for major ones, advise for or against replacement of electric equipment, give advice on blackouts, list second-hand appliances for sale and wanted, and, in general, help customers to get the most from their electric service. When a service representative goes into a customer's home or place of business he is working first for the customer's benefit and then for the company's interest.

These men leave with the customers booklets on the "Care and Use of Electric Appliances." They are furnished for their own use a booklet entitled "Serviceman's Guide," which tells them in simple language what to look for when an appliance does not work properly.

Another important contribution these representatives make is in the fuse-renewal educational program. They show customers how to change fuses quickly and safely and what capacity fuses to install.

The service representatives call on the more experienced lighting, power, rural and home service representatives to assist them when necessary and desirable.

The record of three months in the accompanying table shows how the program is working. The figures of accomplishment per man per day in numbers of interviews, of repairs made and of instructions given, February compared with March, indicate plainly how the service men grew in proficiency as they became fa liar with the work.

At the start there was some appr hension among these salesmen turn servicemen. They were accustom to selling material things, to gettin sales contracts signed, to collecti commissions. They were rather dub ous about this new job of sellin good will—that had no dotted lin to sign on and paid no percentage list price. But they soon learned th contracts and commissions are merel adjuncts of selling and that thei sales abilities were as much necessar in the new work as in the old. The soon realized they were still salesme and that what they sold was as rea as any range or refrigerator.

The customer service representa tive program does not supersede o replace in any way the establishe customer service activities of the com pany. Home, rural, commercial an industrial customer services continu as before; the only differences ar those imposed by the conditions o war.

•

Chicago Dealers Focus on Repair

By JOHN N. WALTON

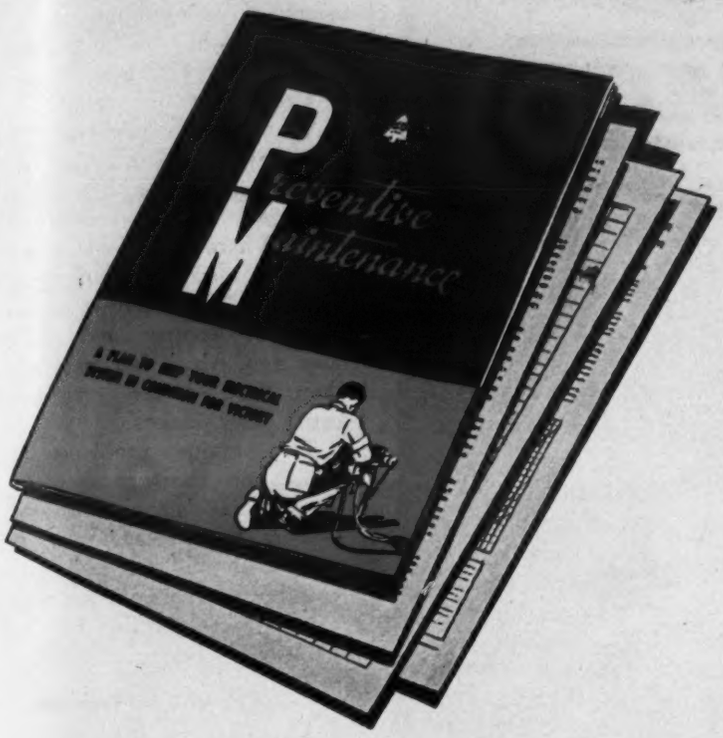
Superintendent Service and Repair Department Commonwealth Edison Company, Chicago

Stocks of new electric household appliances in Chicago stores are nearing depletion under wartime manufacturing restrictions; however, the appliance repair business has spiraled to all-time high levels, a survey of dealers engaged in this activity reveals. Repair agencies are now "rejuvenating" two, three, in some cases four times as many appliances as they did a year ago.

More than 150 Chicago appliance dealers offer their customers repair service. Most of them are going after this class of business much more aggressively today than before

Customer Service Plan

Month	Interviews		Appliance Care Instructions		Repairs Made		Repair Orders Written	Complaints	Fuse Renewal Instructions		Appliances Brought in for Repairs	Appliance Listed		Repairs Referred	Man-Days
	All	per Man per Day	All	per Man per Day	All	per Man per Day			All	per Man per Day		to Sell	to Buy	to Dealers	
February	4,103	3.17	3,280	2.68	1,525	1.18	283	140	2,563	2.14	343	113	304	65	1,296
March	6,217	4.26	6,445	4.42	2,863	1.96	414	106	3,703	2.54	652	205	514	190	1,458
April	7,334	5.22	8,589	6.11	3,095	2.20	436	83	4,552	3.24	624	168	677	403	1,404
Total	17,654	4.24	18,314	4.40	7,483	1.79	1,133	329	10,823	2.64	1,629	486	1,495	658	4,158



OVER 50 UTILITIES

are using the PM plan to spearhead service campaigns

Introduced a short time ago, Anaconda's Preventive Maintenance Plan is being widely used by utilities to help customers keep electrical systems operating *efficiently*—despite shortages in essential wiring equipment.

Already some 50 utilities are actively engaged in this program. With it, they are helping their industrial power customers maintain continuous wartime production by preventing electrical breakdowns.

1 WHAT THE PLAN IS

The PM plan is a simple but comprehensive way to safeguard war production by preventing electrical breakdowns *before they develop.*

2 HOW IT WORKS

The plan provides a practical means of making periodic, systematic analysis of circuits and equipment. Uncovers potential weaknesses . . . suggests ways to correct them . . . prevents overloading of lines.

Data thus gathered aids local W.P.B. Branches in reaching decisions on requests for materials to *prevent* breakdowns.

3 HOW UTILITIES BENEFIT

The PM plan helps utilities maintain close customer contact despite a lack of "something to sell." Offers basis for service campaign that definitely appeals to customers. Puts the utility in a leadership role for furthering war production throughout the area it serves.

If you aren't already utilizing the Anaconda Preventive Maintenance Plan, mail the coupon for full details. 49238

"Tomorrow may be too late . . . do it today!"

ANACONDA'S PREVENTIVE MAINTENANCE PLAN

ANACONDA

Anaconda Wire & Cable Company
25 Broadway, New York City 4

Please send copy of the Anaconda Preventive Maintenance Plan for safeguarding wartime production.

Individual .....

Company .....

Address ..... City .....

8L

Designed to Outlast the Substation

HI-VOLTAGE

Type CW Air Break Switches

● Designed electrically and mechanically to provide more than just efficient performance—actually built to give life beyond the age of the substation. This Hi-Voltage CW Switch is attractive in appearance, involves low installation cost, offers ease of operation and unmatched dependability . . .

Closing—the switch arm swings to the horizontal position in alignment with the contact—moves endways through opening of contact housing into contact.

It is essential that a switch mechanism develops its most powerful leverages at the open and closed positions. Hi-Voltage accomplishes this with a completely housed linkage which controls the motion of the switch arm.

HI-VOLTAGE

EQUIPMENT COMPANY

2891 E. 79th St. • • • • • CLEVELAND, OHIO

because they see in it an opportuni to "weather" the war as well as means of maintaining contact wi customers who will be wanting ne conveniences for their homes wh they again become available.

Although Commonwealth Edis Company has the city's largest appl ance repair service, it is not seekin additional business for this depar ment. Wherever possible, it is diver ing such work to dealers equipped t handle it. The utility is repairing 7 percent more appliances now than year ago, which is considerably le than the increase experienced b many other dealers.

Two major problems—lack o labor and shortage of parts—co front Chicago's appliance repair age cies at the present time. A larg number of skilled workmen formerl engaged in this work are now in th armed forces and they have been dif ficult to replace.

Employee Transfers

The Chicago utility has partiall solved this problem in its repair de partment by transferring employee with mechanical ability from othe divisions of the department in whic the war has caused a slackening o activity. Because the training of these men in all branches of repairing would require much more time than present conditions permit, they are assigned, wherever practicable, t work on specific types of appliances. This specialization enables them t become proficient at their new job in a relatively short time.

Supply of appliance parts in deal ers' stockrooms is considerably smaller than it was before the war. Many of these parts cannot be re placed until industry again convert to peacetime production. Others can be obtained only by returning worn-out parts to manufacturers for re habilitation. This challenge to the ingenuity and resourcefulness of the shop servicemen has thus far been met with conspicuous success. Emergency repair methods are improvised, and by one means and another ap pliances are restored to good health with a minimum use of replacement materials.

There has been no perceptible change in the types of appliance re paired by Chicago dealers since Pearl Harbor. Irons rank first by a sub stantial margin, principally because there are more of them in use than

FREEDOM IS NOT FREE—IT IS PRICELESS ★ BUY WAR BONDS

HUSKY TIMBER
FOR AMERICA'S BIG JOBS

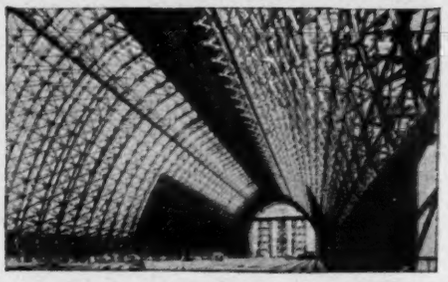
The TECO Connector System of timber prefabrication makes it possible to employ timber *efficiently* and *economically* in heavy structural engineering. Many great war plants, shipyards, docks, warehouses, hangars, bridges, and towers have been built entirely of timber under the TECO Connector System. From the lumber to the finished unit, every step in modern prefabrication is controlled by sound engineering practice. The use of TECO Split-Ring Connectors and TECO precision grooving tools results in a high degree of speed, both in assembly and in erection.

For Modern Timber Construction *Specify* **TECO** Timber Connectors and Tools

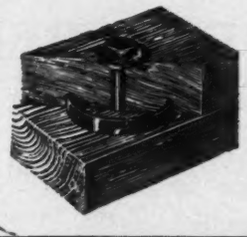
Sponsored Since 1933 By The National Lumber Manufacturers Association

WRITE FOR TECO'S FREE LITERATURE AND LIST OF ENGINEERING SERVICES

3 MILLION FEET OF TIMBER BUILT THIS VAST NAVY HANGAR



Construction view of one of the Navy's mammoth new blimp hangars. Length 1,000 feet; clear-span width 237 feet; height 153 feet. Timber prefabricated by Timber Structures, Inc., Portland, Oregon.



The **TECO** *Ring Connector spreads the load on a timber joint over practically the entire cross-section of the wood . . . brings the full structural strength of lumber into play.*

WASHINGTON, D. C. **TIMBER ENGINEERING COMPANY** PORTLAND, OREGON

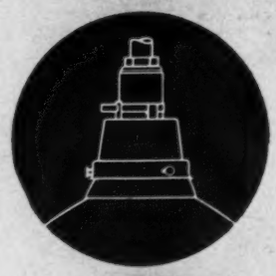
Permaflector NEW

INDUSTRIAL UNITS FOR *Lower* MOUNTINGS

- ***Four Mounting Arrangements***
- ***Three Light Distributions***

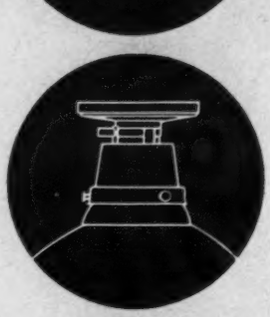
Where units may be mounted 20 feet or less from floor level, these new Permaflector units provide the SIMPLE, INEXPENSIVE, and HIGHLY EFFICIENT WAY to obtain adequate lighting of the work plane.

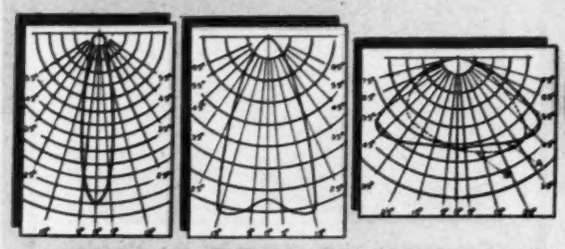
Immediate delivery. Quickly installed, ready for service, simply by connecting wiring. Increase the light output from your present wiring system. Units are available in four different mounting arrangements, three light distributions – concentrated, medium, and broad, for lamp wattages from 100 to 500 watts.



A PERMAFLECTOR UNIT FOR EVERY LIGHTING PROBLEM

For high bay mounting, for intermediate and low bay mounting . . . for mounting 6 to 60 feet and more above the work level . . . for concentrated, medium, or broad light distribution . . . there is a Permaflector to meet your requirements. What can we light for you? Write!





Silvered Glass Will Do It Better!

Permaflectors save on first cost and after cost. They are "shaped-mirrors" of silvered glass, delivering the maximum flux of light where needed and wanted. Permaflectors will not discolor, check, crack, nor peel. They stay clean longer!

PITTSBURGH REFLECTOR CO.

MANUFACTURERS OF LIGHTING EQUIPMENT AND THE FAMOUS *Permaflectors*

OLIVER BLDG. PITTSBURGH, PENNA.

Please send Industrial Lighting Supplement No. 2. EWS-43

Name.....

Company.....

Address.....

any other household electric devi Others high on the list incl de to ers, vacuum cleaners, kitchen mixe washers, clocks, heating pads, coff makers and ventilating fans. Electr refrigerators, repaired in the ma by branch service departments of t manufacturers, also represent a su stantial percentage of the repa business.

Home service representatives the Commonwealth Edison Company who call on the public, now give a pliance repair advice as a part their regular work. These women i spect out-of-order appliances, and the cause of the trouble is only loose connection, broken cord other minor disorder, they sugge necessary adjustments. If it is mo serious, they give the customer th names and addresses of the neare qualified repair agencies.

A broad educational program the wartime care and use of appl ances has been inaugurated by th company. This embraces lectures o the do's and don'ts of appliance op eration presented before the variou women's clubs by experts of the hom service division and practical dem onstrations and exhibits in the com pany's eleven Victory Home Center

•

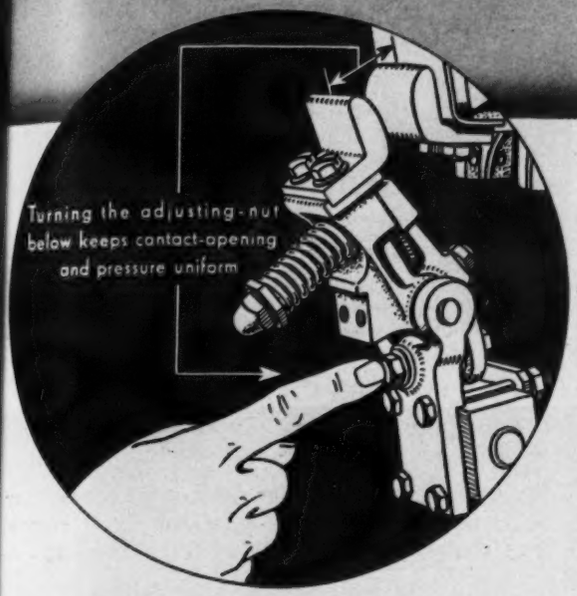
St. Louis Women Share Pressure Cookers

St. Louis is marshaling the pressu cookers in its private homes in an ticipation of a boom canning seaso this summer. As the first step in thi direction the home economics depart ment of the Union Electric Company of Missouri, under the direction o Esther Lee Bride, has completed a pilot survey of 274 homes to deter mine if enough cookers are availabl in private homes and interest suffi cient to make small co-operative com munity canning groups practical. Th survey was made in co-operation wit the St. Louis Nutrition Committee formed by OCD.

Findings of the pilot survey, tabu lated herewith, show a probable city wide average of one pressure cooke to every nine homes. This saturatio is sufficient, in the opinion of th Metropolitan St. Louis Nutritio Committee, to justify organization small co-operative community can ning groups. These groups woul meet either in the homes where pre

Consistent Results in WELDING

CONVENIENT ADJUSTMENT COMPENSATES FOR WEAR AND PERMITS HIGH-SPEED, UNIFORM OPENING



This single adjustment is easy to make and requires only the simplest tools. Any operator can make it and thereby insure consistent welding results by keeping opening-time uniform.

THESE *heavy-duty* LWZ Magnetic Contactors insure good welds at low cost. They are not an adaptation of a standard contactor but are designed especially for *welding service*. They have a readily accessible contact-adjustment which permits high-speed, uniform opening, giving consistent welding results.

Outstanding due to their high arc-handling ability and low upkeep, these EC&M Contactors are unmatched in performance. Deliveries can be made in reasonably good time. Ask for Bulletin 1211.

We build six standard sizes of welder contactors. At the right is the No. 4W size. Ratings are based on duty cycle curves as shown in Bulletin 1211.

THE ELECTRIC CONTROLLER & MFG. CO.
698 E. 79th STREET ★ CLEVELAND 4, OHIO

NUTRITION-

Staten Island Edison Corp.

COMMITTEE MEETS IN HISTORIC HOUSE TO DISCUSS HEALTH-FOR-VICTORY PLANS

With three H-for-V Clubs flourishing on Staten Island, Club officers select famous Revolutionary War Conference House to plan future programs.

Georgia Power Co.

DEHYDRATION OF FRUITS AND VEGETABLES AROUSES KEEN INTEREST AMONG BIBB MFG. CO. MEMBERS

"We'll save precious ration points next winter," say eager Macon, Ga., housewives as they closely examine dried fruits and vegetables after H-for-V meeting.

Atlantic City Electric Co.

MEAL PLANNING GUIDE HELPS DUPONT MEMBER KEEP JUMP AHEAD OF FOOD RATIONING

By following H-for-V tips on "food alternates" and "meat extenders", this enthusiastic New Jersey member makes her precious ration points go farther.

Wisconsin Power + Light Co.

FAIRBANKS-MORSE CLUB MEMBERS GRATEFUL FOR TIMELY, HELPFUL CANNING TIPS

After H-for-V meeting, Beloit, Wisconsin members come forward to examine an interesting exhibit of victory garden foods put up by the utility home economist.

U.S. NEEDS US STRONG
EAT THE BASIC 7 EVERY DAY

Health for Victory

a Wartime Responsibility for the Electrical Industry

No. 2 IN A SERIES

Spotlighting six of the many utilities who are already aiding America's Nutrition Program

The food problem is critical. But somehow, America will provide the food. It will be fairly distributed. Comes, then, the all-important job of teaching America to *use its food wisely*.

No one is in a better position to spearhead the National Nutrition Program locally than the electric utility. Serving both home and industry, you have the public relations facilities and the "Know-how" to insure its success.

Westinghouse offers a nutrition program—now being sponsored successfully by many utilities for 1,300 war plants and other organizations. Our Health-for-Victory plan is flexible and lends itself perfectly to local requirements.

Already, more than 500,000 Meal Planning Guides—64 pages of menus, recipes and food tips—are made available monthly at cost through utilities. Many are given out at utility-sponsored H-for-V meetings. Others are mailed or handed out by industrial relations departments and labor-management committees.

All H-for-V materials are prepared by the Westinghouse Home Economics Institute, and are backed up with a wealth of field experience. The Health-for-Victory activity is ready to be placed at the disposal of any utility desiring to launch a nutrition program. It fits perfectly into the plan recommended jointly by EEI and the Council of Electric Operating Companies for co-operation with the Food Distribution Administration.

DAY AFTER DAY, BONNEY FORGE FAMILY FOLLOWS TO THE LETTER H-FOR-V MENUS

Drop in any time for breakfast, lunch or dinner and you'll find this healthy, war-working family enjoying the particular H-for-V menu recommended for that day.

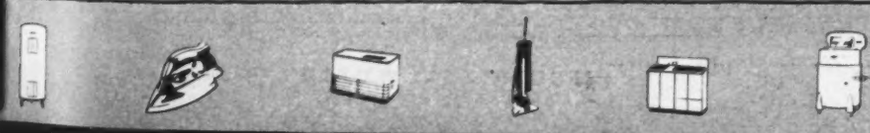
BUTTE TOPS ALL RECORDS DISTRIBUTING MEAL PLANNING GUIDES

D. J. McGonigle (left) and C. J. Burns, Montana Power officials, review with company's home economists H-for-V plans including distribution of Meal Planning Guides to every last one of Butte's fourteen thousand families.

CONTRIBUTION
AMERICA'S
AR EFFORT BY

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE



2¢ WOULD HAVE PREVENTED THIS SHUT DOWN

. . . 2c MORE FOR A NON-RUSTING BOLT IN A VITAL PART

CAN A COUPLE OF PENNIES more per bolt save thousands of dollars? Indeed they can . . . and Harper Fastenings are proving it every day. Saving huge sums by preventing hidden destruction by rust and corrosion. They help war production machinery to stand up under today's grueling speed and overtime.

Such tremendous trifles, these Harper non-ferrous and stainless fastenings. Trifling too, in their extra cost. Yet tremendous in their usefulness.

4320 STOCK ITEMS . . . of bolts, nuts, screws, washers, rivets and accessories in the non-ferrous and stainless alloys.

WRITE FOR CATALOG . . . and reference book —80 pages—4 colors—193 illustrations—numerous tables and other data. Free when requested on a company letterhead.

THE H. M. HARPER COMPANY
2611 Fletcher Street, Chicago
BRANCHES: 45 West Broadway, New York City; 1617 Pennsylvania Blvd., Philadelphia; 332 I. N. Van Nuys Bldg., Los Angeles
Offices in Principal Cities

ARMY E NAVY
Awarded Dec. 7, 1942
Star added June 7, 1943

HARPER *Chicago*
EVERLASTING FASTENINGS

BRASS • BRONZE • COPPER • EVERDUR
MONEL • STAINLESS

sure cookers were volunteered, or in church or other public kitchens, to do their canning under the direction of trained local nutrition experts.

The group canning program as outlined by the St. Louis Nutrition Committee anticipates that pressure cookers for each group of up to eight women shall be operated by the housewife volunteering its use. Food to be canned is to be furnished and prepared jointly by the women in the neighborhood group participating.

Pressure Cooker Survey

Calls 274
Information Refused 5
Did you do any home canning in 1942?

Small	Average	Large
95	63	26

Which of the following methods did you use?

Oven	67	Other method...	31
Water bath	94		
Pressure cooker..	13		

Do you have a pressure cooker? Yes—31 No—241
Holds pint cans..... 13
Holds quart cans..... 18
Are you going to can this season? Yes—249 No—8 Maybe—12
Would you like to have our canning sheet? .....Yes—261 No—4
Would you like to attend a canning demonstration in May?.....Yes—247 No—22

Jars, lids and can rubbers would be furnished by each individual. Canned products would be equally divided among the women co-operating. The owner of the pressure cooker furnishes only her own time, but receives her equal share of canned goods. Pressure cookers are not to be loaned for operation by any one other than the owner.

This plan for community canning groups has been tested out with several large groups of homemakers.

To facilitate and get help into the practical demonstrations on canning, the entire staff of Union Electric Company held refresher courses this spring on canning for both themselves and for volunteer lay teachers, who worked with community groups.

The month of May was set aside with a heavy schedule of canning demonstrations to be held in well-equipped utility kitchens and branch stores for the entire month. Over forty such demonstrations were scheduled.

The pilot survey indicated that 249 of the 274 women contacted anticipated doing some canning in 1943 and that 247 of the number were interested in attending canning demonstrations during May.

The First Line of Defense

No matter how badly the steel mills need scrap, a turbine or boiler will aid the war effort more by staying on the job than by going on the scrap pile.

Inactive equipment . . . equipment nearing condemnation . . . often can be made to serve you for many more months and years when protected — the quick, easy, low-cost way — with APEXIOR. And new equipment can be preserved at peak condition by this essential maintenance and operating material.

The Paint Takes the Wear

Hundreds of industrial power plants, utilities, railroads and marine operators have been using APEXIOR to lengthen the life of boiler or turbine metal. Applied with a hand brush or power-coater, APEXIOR seals up the pores and joints and provides a long-lasting, corrosion-resistant, scale-resistant covering for the metal. The APEXIOR takes the wear, not the metal — and one application lasts 2 to 3 years or more. It is easily renewed.

Painting boiler metal with APEXIOR is recommended by boiler insurance companies. And many manufacturers of turbines coat shafts, rotor bodies, and frequently interiors of casings with APEXIOR before shipping to customers.

APEXIOR is the safe, sure answer to lack of new equipment — the solution to your problem of getting more out of your present equipment. APEXIORIZE — you'll save valuable metal — and in the case of boilers, you'll lengthen periods between cleaning and make cleaning easier (with a wire brush).

Users like these have applied APEXIOR for years. It will help YOU get more service from irreplaceable equipment.

U. S. Army
U. S. Navy
U. S. Maritime Commission
U. S. Coast Guard
U. S. Bureau of Yards & Docks
U. S. Marine Corps
Cunard White Star, Ltd.
New York Central Railroad
Chicago & Northwestern Railroad
Georgia Power Co.
Duke Power Co.
Narragansett Electric Co.
Commonwealth Edison Co.

●

Ease of Applying APEXIOR Explained — Cleaning Simplified

Write, today, for Bulletin 1290 (Industrial) or 1305 (Marine) telling how to get peak production with peak protection.

APEXIOR

A Peacetime Plus ★ ★ ★ A Wartime Must

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

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protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

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Hyde Park, Mass.
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Bulletin 1305 (marine) .....
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Engineering Sales Representatives — Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Manila, P. I., Honolulu, T. H., Marine Dept., 114 Liberty Street, New York, N. Y.

NEW EQUIPMENT

Motors

Drip-proof synchronous motors are applicable to pumping applications where a large volume of fluid is handled, such as

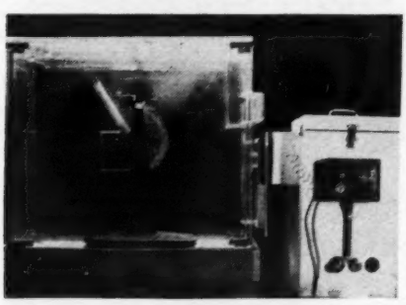
Vertical, high-speed, hollow-shaft synchronous motor; 300 hp., 1.0 p.f., 1,200 r.p.m., 2,300 volts, 3-phase, 60 cycles, type S-965Y, 6-pole. **General Electric Co.**, Schenectady, N. Y.

in ordnance and synthetic rubber plants, and on municipal and government water projects. Frames are of cast-iron construction and top covers of the motors are said to be easily removed to permit adjustment of the pump shaft.

•

Cooling, Heating Unit

Portable cooling and heating unit employs dry ice as a refrigerant and two 1,000-watt electric strip heaters in the air stream as the heating elements. Air is circulated through the unit and discharged by a motor-driven blower. Return air enters the inlet duct below the discharge opening. Temperature is thermostatically controlled.



"Servo" unit supplies air at temperatures from +165 deg. F. to —95 deg. F.; size 17x17x31 in.; rubber-gasketed, clamp-on flange connection provided for air supply and return duct; 110-volt, a.c., 20 amp. Illustration shows a unit serving air to a plastic testing impact machine in a double wall clear plastic chamber. **Tenney Engineering, Inc.**, 8 Elm St., Montclair, N. J.

•

Insulating Material

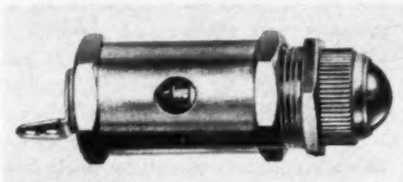
"Synflex FT-22" rubber-like synthetic; elevated temperature resistance of +94 deg. F.; dielectric strength, 1,200 v.p.m. Sizes, B & S No. 24 (0.021 in.) to 2,000 in. I.D. **Industrial Synthetics Corp.**, Irvington, N. J.

Rubber-like tubing is said to be useful for electric insulation or for replacing varnished tubing and sleeving, tine, rubber, aluminum and copper. It is said that it will not support combustion and it has excellent chemical resistance and low water absorption.

•

Pilot Light

New series of pilot lights designed for grounded panels has hexagon nuts integral with body, facilitating solid mounting. Bulb comes out automatically when jewel holder is unscrewed. Uses long or round bayonet base lamps. Available with either plain or faceted jewels.



Series No. 900 pilot lights, 2 in. long, can be mounted on 1-in. centers. **Gothard Manufacturing Co.**, 1300 N. Ninth St., Springfield, Ill.

•

Ballast

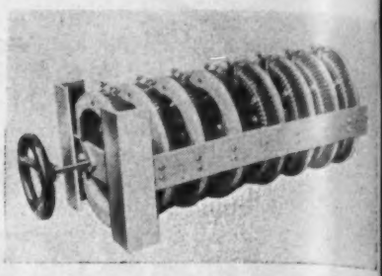
Fluorescent lamp ballast; approved ratings for single, 2, 3 and 4-lamp fixtures, 40-100 watts. **Acme Electric & Manufacturing Co.**, Cuba, N. Y.

Designed for exposed mounting on fluorescent lamp fixtures, new air-cooled type ballast differs from conventional design only in that the leads are brought out through outlets in the base plate. The ballasts will operate at lower ambient temperatures than inclosed type ballasts, it is claimed.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

Tandem Rheostat

New tandem unit is controlled by a single hand wheel. Rheostats are insulated from each other so that they may be used for simultaneous control of several circuits



"Tandem" unit; consists of 8 Model "U" 1,000-watt, 12-in. (diameter) rheostats in steel frame. **Ohmite Manufacturing Co.**, 4835 Flournoy St., Chicago, Ill.

or phases of a circuit by means of one knob. Two rheostats may be separately controlled by means of concentrically located knobs, in order to conserve panel space or where it may be desired to use one rheostat as a vernier for another.

•

Welding Shield

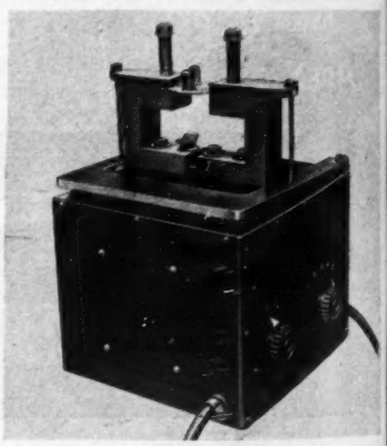
"Huntsman" acetylene and arc welding shield; weights 1-1½ lb. **Davis Emergency Equipment Corp.**, 55 Halleck St., Newark, N. J.

New welding shield has locking device and easily adjustable headgear. The locking device holds the shield in the correct position before the face and holds it firmly above the head while the work is being prepared. A slight nod of the head will lower the shield into the correct working position, it is said.

•

Soldering Transformer

Especially designed for the heating of thin sections, new soldering transformer has transite board which, when pressed by operator, causes the front edges of the copper shoes to spring up, allowing the work to slide in. When he removes his hands, the work is firmly clamped in the terminals. Five heat speeds give ten heat ranges for the various grades of work.



Type "T-37" soldering transformer; capacity 4 kva.; one-turn secondary with voltage range, 0.3 to 0.9. **American Car & Foundry Co.**, 30 Church Street, New York, N. Y.

1. Wet Process Porc. Ins.
2. Wet Process Porc. Tube
3. Exhaust Shield
4. Line Terminal
5. Arc Horn
6. Ground Terminal
7. Steel Sleeve
8. Fibre Sleeve
A. Composite Fibre Barrier
B. Threaded Cap
C. Fibre Tube
D. Electrodes
E. Stud
F. Fibre Exhaust Sleeve
G. Washer
H. Threaded Sleeve
J. Exhaust Vents
K. Exhaust Ports
Q. External Gap

HUBBARD AUTOGAP LIGHTNING ARRESTERS

The path of a lightning discharge through a Hubbard Autogap Arrester is shown by the heavy red line, solid and broken. Arrows show the course of exhaust gases after the arc is blown apart. Although, for sake of clarity, the illustration shows numerous "streamers" encircling the barrier "B", this is not necessarily true to fact, since the path MAY be single for each operation but through many operations, will seek a multitude of DIFFERENT paths.

1 The Autogap Barrier "B" offers a cylindrical gap of fibre between electrodes "D". In operation, the path of lightning discharge is over any part of the surface of this cylindrical barrier. THERE IS NO "BEATEN PATH"!

2 Due to the gap "Q" the barrier "B" is not in a leakage path to ground, therefore not subject to CONTINUAL burning by leakage currents. This feature also provides Hubbard Autogaps with a long life of service. AUTOGAPS OPERATE ONLY WHEN NEEDED.

3 The "explosion" resulting from operation under excessive voltage is exhausted in two opposite directions from the barrier with ample freedom of passage to the open air. One more point providing longevity of service without interruption or MAINTENANCE.

4 Installation may be made on crossarm, pole or transformer and all three types may be easily covered with rubber blankets. Unexposed line connection styles may be obtained if desired.

5 Made in several styles, various capacities and with mountings for any circuit, all styles operating on the same principle.

Make a note of these Features—

HUBBARD

HUBBARD AND COMPANY

This set of.. will handle many hot line maintenance jobs

TIPS TOOLS

Repair up to 15 KV lines with this low cost equipment . . .

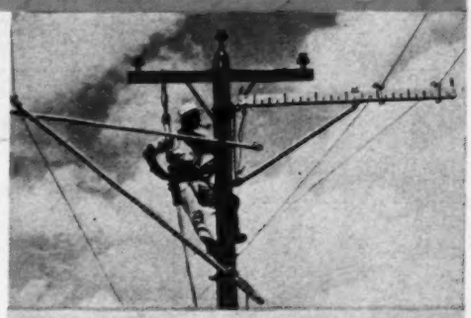
This Tips Tool Set No. 4800-10 gives you the minimum essentials for doing hot line repair work on straight line construction up to 15 KV. It may be used in a variety of ways to do a variety of jobs. The Auxiliary Arm may be used as a side arm or as a lifting arm in combination with the Wire Tongs. The Wire Tongs may be used together for lifting a single conductor into the clear, or one tong may be used to make a straight lift as illustrated.

With this set of tools, a maintenance crew can remove or replace poles, cross arms, insulators, etc., in complete safety without interrupting service. It is the first step towards outfitting maintenance crews with complete equipment for handling all maintenance work "hot." Additional tools may be added as the requirements demand. Many services do not require more than these few essentials.

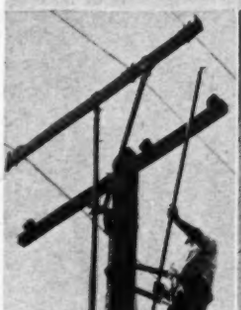
A single job will most likely pay for this inexpensive tool set.

For other more complete equipment, consult your Tips Tool catalog.

For special equipment and demonstration service, write direct to the A. B. Chance Company.

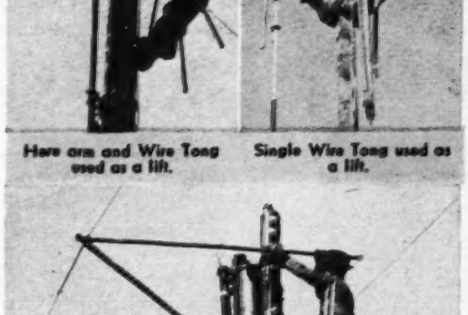


Showing the use of the complete tool set to handle three phases. Note side arm.



Here arm and Wire Tong used as a lift.

Single Wire Tong used as a lift.



Here the Wire Tong set is used to place the conductor at a safe distance to the side.

Instruction pages in this catalog show how to do 24 different hot line jobs.

A·B·CHANCE CO·
CENTRALIA, MISSOURI.

ABC Industries

TECHNICAL LITERATURE

REPORT—"Turbine Operating Records for Years 1940-1941," a report by the Turbine Subcommittee of the Prime Movers Committee of E.E.I., tabulates data on 366 turbine installations, 18,000 kw. and larger, and 40 high-pressure units operating above 1,000 lb. pressure. Copy of publication No. K-5 may be obtained from Edison Electric Institute, 420 Lexington Ave., New York, N. Y.; price 75 cents to non-members in U. S. A.

FEEDWATER—"Boiler Feed Water Conditioning and Chemistry" deals with some common processes in feedwater conditioning, and discusses factors such as characteristics of hot process water softener, removal of gases from boiler feed water, embrittlement and carry-over. A section is devoted to interpretation of water analyses, chemical reactions and equivalent weights of all the chemicals commonly found in water-conditioning practice. Publication 4008 may be obtained from Cochrane Corp., 17th & Allegheny Ave., Philadelphia, Pa.

WELDING ALLOYS—Physical properties and procedure information on 46 low temperature welding alloys is contained in concise form on a welding chart obtainable from Eutectic Welding Alloys Co., 40 Worth St., New York, N. Y.

STOKERS—Operating and maintenance suggestions and inspection charts are contained in booklet B-3257, Operating Guide for Single Retort Stokers, which may be obtained from Dept. 7-N-20, Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

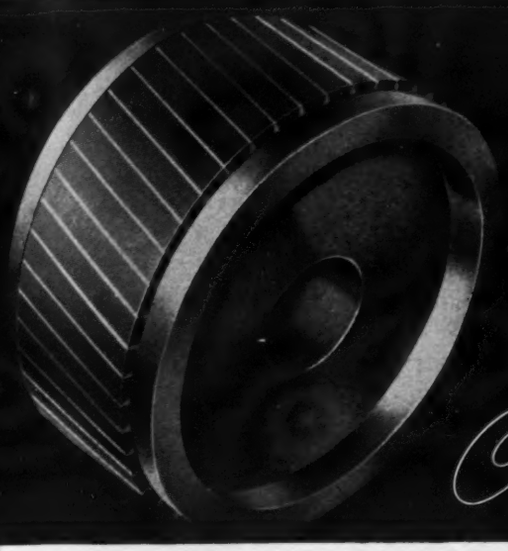
STORAGE BATTERIES—A simple manual, "Facts of Life for Your Storage Battery," explains the make-up of a lead battery and gives non-technical instructions as to its proper care and maintenance. Copy may be obtained from Gould Storage Battery Corp., Depew, N. Y.

WELDING DATA—Bulletin "Recommended Practices for the Spot and Seam Welding of Low Carbon Steel" contains data which have been approved and published as standard practice during the war emergency. Copies may be obtained from the American Welding Society, 33 West 39th St., New York, N. Y., in the form of a 4-page leaflet, 6 in. x 9 in., price 10 cents.

ELECTRIC CORDS—A set of six charts, each 14¼ by 20 in., entitled "Repair Your Electric Cords," covers subjects such as attaching an outlet plug, splicing, preparing wires for reconnection, and attaching an appliance plug. These have been prepared by Bureau of Human Nutrition and Home Economics, Agricultural Research Administration, U. S. Department of Agriculture, and may be ordered from Superintendent of Documents, Government Printing Office, Washington, D. C.; price 30 cents per set of six.

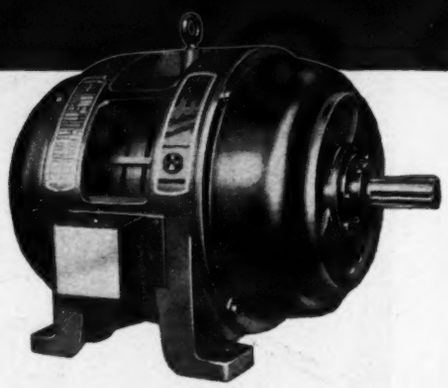
DRESINATES—Properties of liquid and powdered forms of water soluble resinates are contained in a four-page pamphlet "Dresinate in Soluble Oils." Both forms are used in cutting oils for metal working, for dispersing germicidal disinfectants throughout water, in leather treating oils, textile oils and other emulsions. Copies of the booklet can be obtained from Paper Maker's Chemical Department, Hercules Powder Co., Wilmington, Del.

You don't need Extra Size



With this Extra Quality

Copperspun



• No need to tell you that wartime restrictions make it impossible for you to get extra-size or extra-horsepower motors for any job that calls for specific horsepower.

But don't let that worry you for a single moment. Put Fairbanks-Morse Motors with Copperspun Rotors on the job—and you *do not need* extra horsepower or extra size.

The reason, briefly stated, is this: The winding of the F-M Copperspun Rotor is centrifugally cast, in *one piece,* of pure *copper.* No other rotor is cast of *copper.* Copper has better thermal characteristics. Copper has better electrical characteristics. For these reasons, you can run a Fairbanks-Morse Motor with Copperspun Rotor *under full load indefinitely* without danger of damage through overload.

Naturally you'd rather not buy horsepower you don't need — if you can do so safely. Now you can.

Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago. Branches with service stations throughout the United States and Canada.

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DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

F M

Motors

M-R

EXTRUDED PLASTIC TUBINGS

HAVE ALL THE QUALITIES TO MEET TODAY'S INSULATION REQUIREMENTS!

Mitchell-Rand Extruded Plastic Tubings are fast making friends with the progressively difficult insulation tubing problems and applications generated by today's advances in electrical and electronic developments.

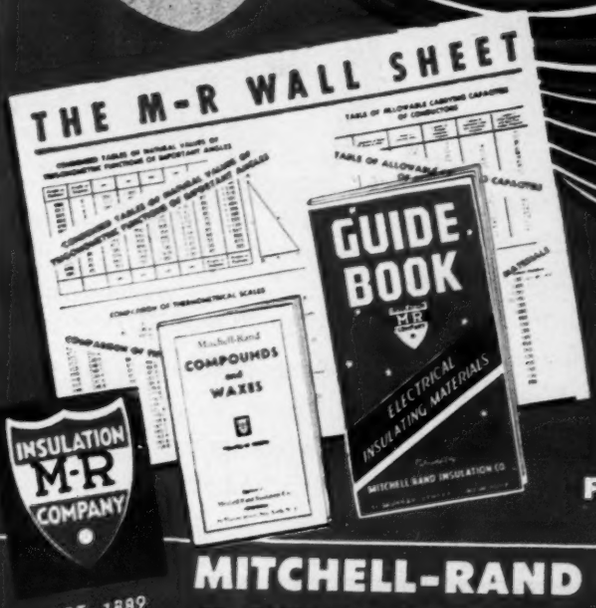
Their properties make them ideal for today's insulation tubing applications. Mitchell-Rand Extruded Plastic Tubings are made in four grades; MIRAFLEX, MIRATEN, MIRAGLAS and MIRADIE. Miraglas and Miradie are transparent. Miraflex and Miraten are made in six colors.

If Extruded Plastic Tubings don't apply to your particular applications bring your tubing problems to Mitchell-Rand "The Electrical Insulation Headquarters" for the specific tubing to meet your needs.

	MIRAFLEX	MIRATEN	MIRAGLAS MIRADIE
Dielectric Strength .020 Wall Dry	750 VPM	1000 VPM	850 VPM
Wet	350	1000	815
Water Absorption after 34 hours	1.5%	0.5%	0.4%
Tensile Strength lbs. per sq. in.	2,150	4,000	3,000
Life at 105° C.	400 hrs.	1,000 hrs.	
Resistance to Brittleness	Does not become brittle or shatter at —40° F. —58° F. —50° C		
Wemco Oil Test 48 hours.—100° C.	All grades passed satisfactorily		

MITCHELL-RAND *for* **54 YEARS THE ELECTRICAL INSULATION HEADQUARTERS**

NON-COMBUSTIBLE
EXTREMELY HIGH DIELECTRIC
GREAT TENSILE STRENGTH
SOLDERS SUCCESSFULLY
AGES VERY WELL
FLEXIBLE AND ELASTIC
RESISTS SOLVENTS
RESISTS HIGH AND LOW TEMPERATURES
RESISTS ABRASION
WON'T BRITTLE
THIN OR THICK WALLS
MOISTURE PROOF
MADE IN TRANSPARENT AND SIX COLORS



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INSULATION M-R COMPANY
EST. 1889

MITCHELL-RAND INSULATION COMPANY, INC.
51 MURRAY STREET COrtlandt 7-9264 NEW YORK 7, N. Y.

A PARTIAL LIST OF M-R PRODUCTS

Fiberglas Varnished Tape and Cloth
Insulating Papers and Twines
Cable Filling and Pothead Compounds
Friction Tape and Splice
Transformer Compounds
Fiberglas Braided Sleeving
Cotton Tapes, Webbings and Sleevings
Impregnated Varnish Tubing
Insulating Varnishes of all types
Fiberglas Saturated Sleeving and Varnished Tubing
Asbestos Sleeving and Tape
Extruded Plastic Tubing
Varnished Cambric Cloth and Tape
Mica Plate, Tape, Paper, Cloth and Tubing

NEWS ABOUT PEOPLE

ew Appointments Made by Detroit Edison Co.

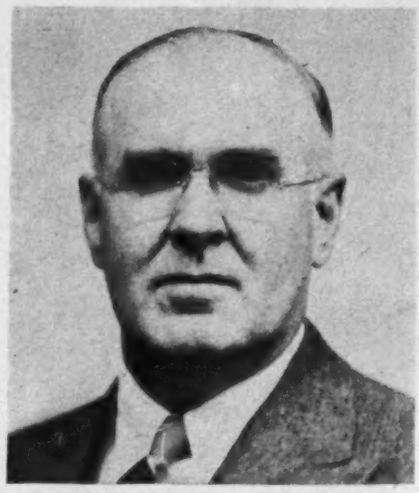
Announcement has recently been ade by the Detroit Edison Co. of the pointment of a director of research d a new superintendent of meters.

Henry S. Walker, who was appointed rector of research, started as a student the Detroit Edison research depart- ent 22 years ago, working his way up rough the ranks. He is a graduate of e University of Detroit with the degree bachelor of mechanical engineering d is a member of the Engineering So- ety of Detroit, the American Society Mechanical Engineers and the Michi- n Engineering Society. As director of search he has charged of the com- ny's research laboratory, which is incipally concerned with operating roblems designed to reduce costs and

. S. Walker

mprove service, and the company's ref- rence library.

Walter G. Knickerbocker, before his ppointment as superintendent of neters had served as assistant superin- endent for 14 years. His employment ith the company began in the property ivision, shortly after his graduation in 916 from Michigan State College as a achelor of science in electrical engi- eering. Mr. Knickerbocker is a mem- er of the Engineering Society of De-



W. G. Knickerbocker

troit, the American Institute of Electri- cal Engineers and the meter committee of the Edison Electric Institute.

•

▶C. J. STRIKE, president and general manager of the Idaho Power Co., has been appointed president of the Idaho War Fund, which includes all of the agencies in the state that are seeking funds for war purposes.

▶GEORGE R. VANNAMEE, whose retirement as a member of the New York Public Service Commission became effective last week, was given a testimonial scroll signed by more than 200 commission employees at a brief ceremony held at the State Building in New York. Mr. Van Namee, who will resume private law practice after a brief vacation, will be succeeded by George A. Arkwright of Brooklyn.

▶P. M. GEE, division engineer, Consolidated Edison Co. of New York, N. Y., Inc., has retired. After spending one year in the student engineering course of the General Electric Co., Pittsfield, Mass., he worked in the testing department at Schenectady. Subsequently he served as assistant chief inspector of assembled switchboards and then as switchboard designing engineer. From 1915 to 1917 he worked as designer for Stone & Webster, Boston. He commenced his 26-year association with the Edison system in 1917 as foreman for the Brooklyn Edison Co. Later he was made chief electrical draftsman and then assistant engineer. He was made division engineer in 1929 and in that capacity was transferred to the Consolidated Edison Co.'s inside plant department in 1936.

▶ROBERT MONTGOMERY, vice-president of the Louisville Gas & Electric Co., Louisville, Ky., has been named chairman of the executive committee of the Louisville Committee for Economic Development.

•

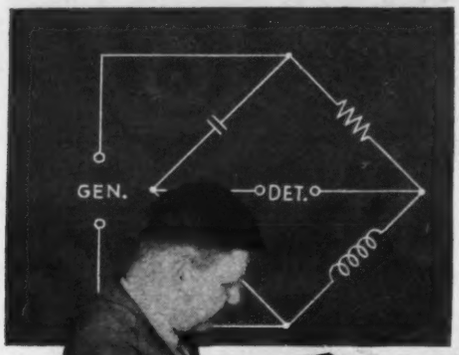
Reliance Electric Names Harrell Chief Engineer

Fred E. Harrell, assistant chief engineer of the Reliance Electric & Engineering Co. since 1934, has been appointed chief engineer of the company, reporting to A. M. MacCutcheon, engineering vice-president. For the past ten months Mr. Harrell has been acting as executive director of a new marine division plant for Reliance. Greatly increased demands on the company's engineering staff have made imperative Mr. Harrell's resumption of responsibilities in the engineering department.

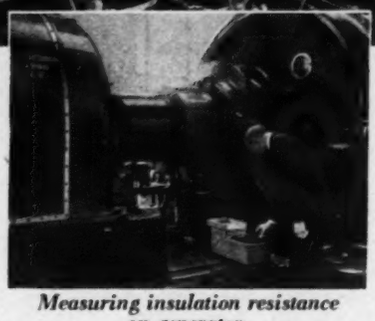
A native of Logansport, Ind., Mr. Harrell became identified with Reliance in 1924 upon graduation in electrical engineering from Purdue University. In

1927 he was transferred from sales engineering in the company's Chicago office to general engineering in Cleveland. Since then he has had charge of the drafting room, of alternating-current design work, and since 1934 has been assistant chief engineer.

A fellow of the American Institute of Electrical Engineers, Mr. Harrell is also the chairman of the institute's committee on electrical machinery and a past-chairman of the Cleveland section of the institute. He is a civilian member of the



Impedance bridges



Measuring insulation resistance on generator.

ONE of the fundamental measurements in every branch of electrical engineering is that of impedance, now more important than ever because of the rigid specifications to be met in the production of war material.

In circuits with lumped constants the accepted means of impedance measurement is comparison by a null method, using an a-c adaptation of the Wheatstone bridge. Impedance bridges have been a General Radio specialty for nearly 25 years. A program of continuous research into methods, circuits, and circuit components has led to increasingly better designs and more useful instruments. For measuring both the reactive and resistive components of impedance at all the important frequencies between 60 cycles and 60 megacycles, there is a General Radio bridge to do the job.

Because all our facilities are devoted to war projects, these impedance bridges are at present available only for war work.

GENERAL RADIO COMPANY GR

CAMBRIDGE • MASSACHUSETTS

NEW YORK • LOS ANGELES

Radio frequency bridge in broadcasting station.

Capacitance test bridge measuring transformer bushings.

American Society of Naval Engine and a member of the Cleveland Eng neering Society.

•

Clark Named Westinghou Engineering Manage

Appointment of Earl K. Clark manager of the Westinghouse appl ance engineering department and H. Cummins as assistant manager was a

E. K. Clark

nounced recently by J. H. Ashbaugh manager of the company's electrica appliance division. Mr. Clark succeed W. J. Russell, who resigned recently to become vice-president of Landers Frary & Clark, New Britain, Conn. Mr Cummins' post is a new position cre ated to develop further liaison wor

H. R. Cummins

in peacetime between the engineering and sales departments, the announce ment said.

During the 21 years that Mr. Clark has been a Westinghouse engineer he has been responsible for many devel

S-h-h... it's a "civilian secret"!

New, improved MILLER 50 FOOT CANDLER and 100 FOOT CANDLER Continuous Fluorescent Lighting Systems coming back—look for the BIG NEWS here next month!

hree years ago we introduced the first ontinuous fluorescent lighting systems — MILLER 50 AND 100 FOOT CANDLER.

his meant that for the first time in- ustry really could have adequate man- ade daylight *indoors* — of 30, 50 or ore footcandles — for better, faster, fer production.

his meant considerable *installation sav- gs*—both time *and* dollars—over con- ntional incandescent or fluorescent fix- re hookups. Savings of from 30 to 50% a matter of fact.

his meant *simplified lighting mainte- nce* — reflectors so easy to remove, ndle and clean that women workers could take care of them.

Then war hit! And, cockeyed as it sounds, the very production requirements which this better lighting served so well created shortages in metals and other vital materials that temporarily cramped our style.

Now MILLER engineers have licked those headaches — and they're bouncing back with a new, and further improved 50 FOOT CANDLER AND 100 FOOT CANDLER that's going to give you all these lighting benefits to help you with your production and manpower problems.

If your war demands are so great you can't wait, drop us a line and we'll see what advance dope we can send you now.

THE ABOVE LIGHTING LAYOUT *will give you a faint hint of what's coming — an improved, streamlined version of the most successful lighting system in use in industry today — and pioneered by* MILLER.

SAFETY FIRST!
Among many noteworthy MILLER *fluorescent features is this patented* safety lamp lock *that minimizes the danger of lamps falling. It is an integral part of each socket, simple in operation, foolproof, and sound accident insurance.*

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

UPTEGRAFF

distribution TRANSFORMERS

Uptegraff Distribution new Type UD Transformer for either pole or crossarm mounting

5 lbs. to 5 tons of Important Little Things

— and delivered on time

Steel, copper, and oil or other cooling liquid—these are the make up, the flesh, blood and sinew, of Uptegraff Transformers.

We don't make all types, we don't make all capacities—but if your Transformer needs, future or immediate, come in our wide range you are certain of an extra measure of service and satisfaction by using the engineering and production facilities of the Uptegraff organization.

Specializing solely in the design and making of Transformers, adhering to our own types and capacities, over a period of a quarter of a century there has grown a sound faith in the treasured reputation of the extra "Quality and Service" built into all Uptegraff Transformers.

Tell us what you want, when you want it, and see us meet your requirements.

R·E·UPTEGRAFF MANUFACTURING CO·
SCOTTDALE PENNSYLVANIA U·S·A·

Uptegraff QUALITY SERVICE

opments that improved electric appliances. Credited with 44 patents, his outstanding contributions include the engineering work on the streamlined iron, introduced in 1935; development work on water heaters, and improvement of control equipment for small appliances. For the past four years Mr. Clark has been section engineer in charge of thermostats and controls.

Mr. Cummins served in the sales and advertising departments of the company from 1935 until 1942, when he was transferred to the engineering department.

▶ J. J. BARRY, New England sales representative of the Winchester Repeating Arms Co., New Haven, Conn., has severed his connection with the company.

▶ CHARLES S. POWELL has been appointed communications and merchandise manager of the Graybar Electric Co. He has been district manager in Boston since 1940 and has a record of 29 years with the company as telephone specialist, radio specialist, branch manager and telephone sales manager.

▶ C. LOUIS GAGNEBIN, JR., for the past three years manager of the Brookline office of the Boston Edison Co., and for 13 years in the power sales department, has severed his connection with the company to become associated with the National Co., Inc., Malden, Mass., makers of communications equipment. He joined the Edison organization 19 years ago after being graduated from Harvard College in the chemical engineering course. Mr. Gagnebin has served as co-ordinator of the American Radio Relay League and is a member of the planning and protection division of the Brookline Committee on Safety.

▶ ADOLFO ALVAREZ has been appointed general South American representative of the Westinghouse Electric International Co. Mr. Alvarez will devote his time to formulating plans for the company's war and post-war development. A citizen of Argentina, Mr. Alvarez is also vice-president of Cia. Westinghouse Electric International, a South American subsidiary of International.

▶ H. B. LEACH, assistant superintendent, Consolidated Edison Co., New York, has retired. Mr. Leach had completed 31 years with the Edison Company and its predecessors. He entered the employ of New York Edison Co. in 1913 after five years (1905-10) with the Wilmington (Del.) City Electric Co. and three years (1910-13) with the Westchester Lighting Co., Mount Vernon, N. Y. Until 1918, when he was transferred to the test department, he worked in the meter department of the

PERMANENT MAGNETS MAY DO IT BETTER

Are You, Too, Planning For "*The Age of Electronics?*"

WITH many electronic developments proving successful on the battle-fronts, it's only natural for America's scientists and engineers—busy as they are—to sense the importance of peace-time applications from the miracles they have wrought. And the postwar results of their thinking will create "The Age of Electronics."

Whether you are manufacturing war matériel or planning peacetime products, have you considered incorporating the principle of the *permanent magnet?* Permanent magnets of our design and manufacture are used in many of the war's outstanding electronic developments and in countless other important devices—increasing their uses and improving their functions. 33 years of specializing in this *one* field has enabled us to make valuable engineering contributions. Very likely we can help *you*, too.

Though our plant (the nation's largest specializing in the making of permanent magnets) is devoted to war orders, our engineers will be glad to consult with you and give your problems the benefit of their unusual experience. Write for the address of our office nearest you and a copy of our 30-page "Permanent Magnet Manual."

Back the attack with an EXTRA Bond—and help increase production!

The
INDIANA STEEL PRODUCTS
Company

★ SPECIALISTS IN PERMANENT MAGNETS SINCE 1910 ★

6 NORTH MICHIGAN AVENUE • CHICAGO, ILLINOIS

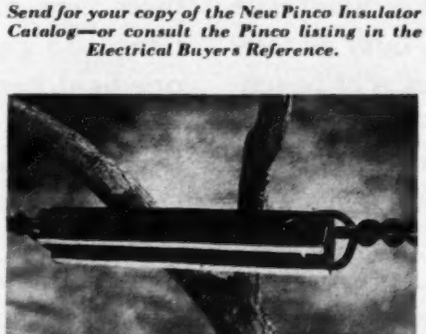
what "RIGHT ON THE JOB" really means . . . . .

The heavy naval gunfire and aerial bombardment that paved the way for one of America's invasion forces wrecked many shore installations. Among them were the power facilities for much needed loading and unloading machinery at the docks. Quick repairs were essential. But insulators, radically different from standard American types, were unavailable.

Drawings of these insulators were flown to the U.S.A. . . . and on to The Porcelain Insulator Corporation. Within five weeks the entire shipment was on its way . . . in spite of the fact that metric measurements had to be translated to their American equivalents, that new working drawings, tools and molds had to be made.

Here is an example of Pinco's war service . . . yet the same "right on the job" service that established the Pinco reputation in times of peace . . . the kind of service that comes only from a smoothly functioning organization long geared to the handling of emergency work.

Send for your copy of the New Pinco Insulator Catalog—or consult the Pinco listing in the Electrical Buyers Reference.



PINCO TREE INSULATOR

A new Pinco specialty that fills a real need for protecting tree, line and service. All porcelain. Economical and easy to install. Line and laboratory tested. The Superintendent of the Construction Division of a large Eastern Utility says, "These tree insulators have worked out very satisfactorily and are superior to the ones we have tried previously.

PINCO INSULATORS

The PORCELAIN INSULATOR CORPORATION

645 Main St. E. Lima, N. Y.

SALES AGENTS—The Jodyn Company—New York, Rochester, Philadelphia, Baltimore, Lynchburg, Va.; Jobbers Supply Co.—St. Paul, Portland, Seattle; Jodyn Co. of California—Los Angeles, San Francisco, Phoenix, Ariz.; Southern Jodyn Co.—New Orleans; H. E. Burns Co.—Pittsburgh; J. J. Costello—Boston; Southeast Jodyn Company—Cincinnati, Cleveland, Westerville, O., Lexington, Ky., Atlanta, Jacksonville, Paul Daudon—Denver; Paul Carson—Amarillo, Texas; Jodyn Manufacturing & Supply Co.—Chicago, Springfield, Ill., Kokomo, Ind., Kansas City, Omaha, Oklahoma City; Jodyn Southwest Co.—Dallas, Houston.

Edison Company. In 1920 he was made chief tester and in 1923 became foreman of the test division of the United Electric Light & Power Co. He was named general foreman of the meter and test department in 1930. Appointed assistant superintendent of the New York Edison Co. in 1935, he continued in that position with the Consolidated Edison Co. after the 1936 merger of the New York companies.

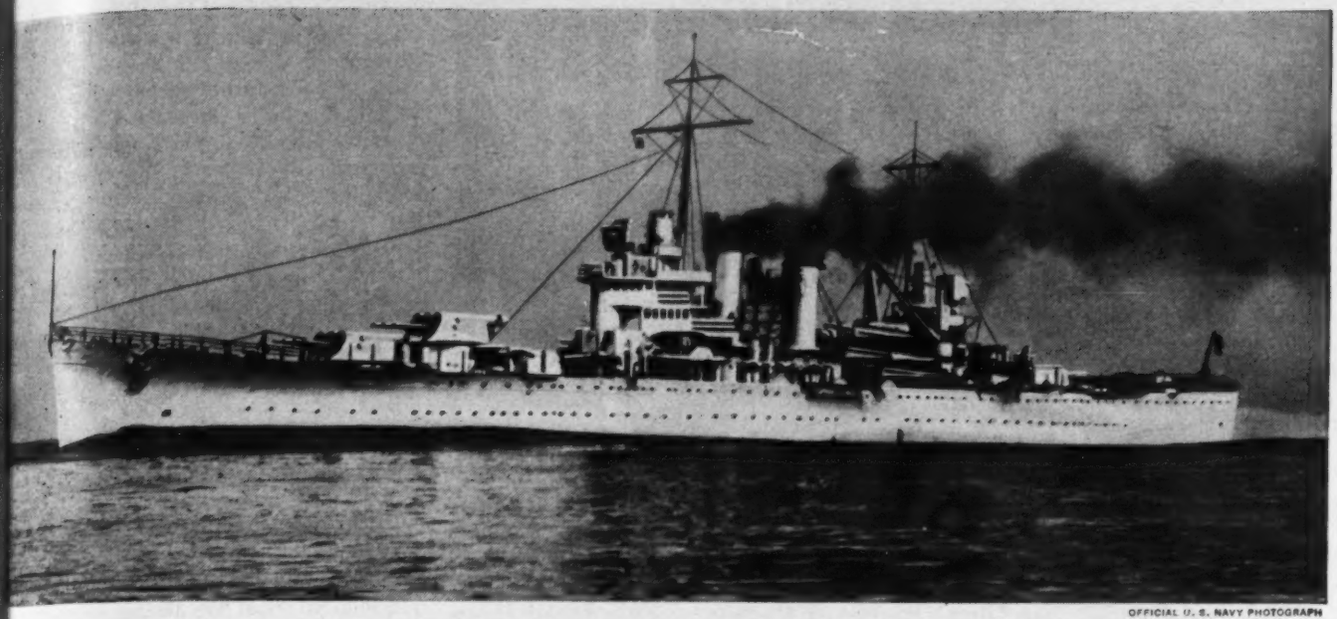
▶R. H. MANAHAN, chief of the electrical division, department of building and safety, Los Angeles, has retired. An ordinance automatically retires any city employee on reaching the age of 70. Mr. Manahan had completed 43 years of service as city electrician, and during this period he was active in the affairs of the Southern California chapter of the International Association of Electrical Inspectors. The city of Los Angeles has abolished for the duration, the position made vacant by Mr. Manahan's retirement.

▶CLARENCE V. BECK has been appointed a member of the Kansas Corporation Commission to succeed JEFF A. ROBERTSON, who has resigned to enter military service. The new commisioner is a former state attorney-general. He retired from that office in 1939 after two terms of service, and has since been in general law practice in his home city of Emporia.

▶JOSEPH H. YARNALL has been appointed superintendent of power for the Boston (Mass.) Elevated Railway, succeeding the late Frederick S. Freeman. Mr. Yarnall was born in Sunbury, Pa., 58 years ago and was graduated from Pennsylvania State College in 1905, receiving the degree of electrical engineer from the institution in 1906. He entered the Boston company's electrical engineering department in that year; in 1909 he was appointed assistant engineer and in 1923 was transferred to the office of the superintendent of power with the title of power engineer. Last March he was named assistant superintendent of power.

▶GEORGE A. SAWIN, JR., New England district promotion manager for Westinghouse Electric, Boston, has been elected president of the Technical Advertising Association.

▶HAROLD D. KELSEY has been appointed assistant to the manager in charge of engineering at the Fort Wayne Works of the General Electric Co., succeeding the late R. H. Chadwick. Entering the employ of the company in 1920, Mr. Kelsey completed the test course and then was assigned to the turbine engineering department at Schenectady. In 1929 he was appointed engineer in charge of the engineering section of the centrifugal compressor de-



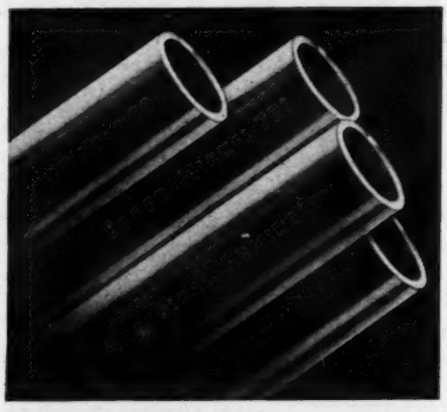
OFFICIAL U. S. NAVY PHOTOGRAPH

U.S.S. Boise returned with her *original* Condenser Tubes

How the *U.S.S. Boise* triumphed in sending six Jap warships to Davy Jones' locker is history. How this gallant ship then limped home unescorted—*under her own power*—is more history.

That her original condenser tubes were still serviceable is a "detail" not likely to be included in most accounts of her remarkable feat. But we remind you that she went into the epic Coral Sea battle with the Ambrac Condenser Tubes which were originally installed in 1936.

Today The American Brass Company is supplying for naval construction large amounts of copper-nickel alloy condenser tubes, the best alloy to meet the severe service imposed on the condenser of a fighting ship.



Condenser Tubes, in a wide selection of special-purpose alloys developed through long years of experience, are made by The American Brass Company. We are equipped to render engineering assistance on problems involving their use. You'll likely find our 58-page manual on Anaconda Tubes and Plates both interesting and helpful. If you haven't a copy, just ask for Publication B-2. 4385

Well made tubes of the right alloy will cut repair time losses at this critical period when lost time cannot be replaced.

Anaconda Condenser Tubes

THE AMERICAN BRASS COMPANY • General Offices: Waterbury 88, Connecticut
Subsidiary of Anaconda Copper Mining Company
In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

BUY ALL THE BONDS YOU CAN AFFORD . . . TURN IN ALL THE SCRAP YOU CAN FIND

DANGER SPOTS

Care and Repair "In Time" through Regular Cable Inspection

WHAT GOES ON down every manhole today is of utmost importance to metal reserves and war production. Unnecessary cable failures can be eliminated by periodic inspection. Those large industrials and electric utilities who have made regular, careful manhole inspection routine are making an important contribution to Victory.

Here are two maintenance tips to give manhole installations longer life wherever lead cable is used:

RERACK WRINKLED CABLES TO HIGHER RACKS

This eliminates sharp bends and prevents wear on wrinkled portions. Install porcelain bells at cable duct entrances to eliminate damage from sharp edges. Duct shield may be slid in at duct mouth with metal shield around cable to hold it—to prevent wear.

FIREPROOFING OF CABLE

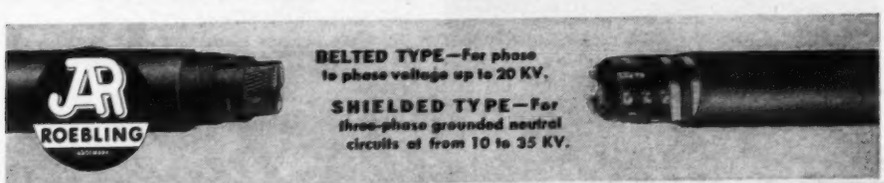
Prevent communicating faults through fireproofing. On higher voltages—13 to 25 kv, apply cement or other equivalent or preferred flameproofing material on all exposed cable in manhole. Lead cable sheath should receive a protective coating before either cement or asbestos or other flameproofing is applied.

★ ★ ★

Inspect manhole cables regularly. Make repairs promptly. Use Roebling paper—and lead-insulated cables for long service on underground transmission, distribution or service circuits.

JOHN A. ROEBLING'S SONS COMPANY

TRENTON, NEW JERSEY • *Branches and Warehouses in Principal Cities*


JR
ROEBLING
BELTED TYPE—For phase to phase voltage up to 20 KV.
SHIELDED TYPE—For three-phase grounded neutral circuits at from 10 to 35 KV.

ROEBLING

ELECTRICAL WIRES AND CABLES

partment at the Lynn River Works. Three years later he was also made engineer in charge of the mechanical drive section, turbine department, at the Lynn Works. He continued in this capacity until 1931, when he was named engineer in charge of the engineering section of the air-conditioning department at Schenectady and Bloomfield, N. J. Mr. Kelsey was appointed engineer in charge of air conditioning and commercial refrigeration departments in 1939, and two years later became engineer in charge of the engineering department of the Fort Wayne Works and held that position until his present appointment.

▶ EUGENE WADMAN, formerly head of the lighting department of the George H. Wahn Co., Boston, Mass., has been appointed lighting sales engineer of Sylvania Electric Products, Inc., with headquarters at the Boston office.

▶ FRED H. CURRIE of Los Angeles has been appointed Pacific Coast sales manager of the steel division of the Copperweld Steel Co.

▶ R. C. NEILSON has been named sales manager of the New York office of Landers, Frary & Clark to succeed the late H. R. Owen. Mr. Neilson joined the sales staff of Landers, Frary & Clark in 1914.

▶ MATTHEW R. ROSSE has been appointed sales manager of the export division of the Wickwire Spencer Steel Co., succeeding W. H. Lynn. Before joining Wickwire Spencer Steel Co. Mr. Rosse was assistant export sales manager of the American Chain & Cable Co.

▶ C. B. COOK has been appointed vice-president of the Elwell-Parker Electric Co. in charge of advertising, sales promotion and export sales. A director of the company since 1941, Mr. Cook has been identified with the company for the past 28 years. A graduate of Rose Polytechnic Institute, he continued his engineering education through the apprenticeship course at the Bullock Works of Allis-Chalmers Manufacturing Co., becoming a member of its sales force in Cleveland in 1907. From 1908 to 1912 he was manager of the Toledo office of Allis-Chalmers and from 1912 to 1914 he was Ohio and Michigan district manager for Stevens-Duryea Co. In 1914 he became affiliated with the Elwell-Parker Electric Co. Mr. Cook is a member of the Cleveland Chamber of Commerce, president of the Cleveland Export Club and a director of the National Industrial Advertisers Association. He is also a member of the Industrial Truck Statistical Association's market development committee.

Your Bond Selling Responsibilities Double!

Starting September 9th, your Government will conduct the greatest drive for dollars from individuals in the history of the world—the 3rd War Loan.

This money, to finance the invasion phase of the war, must come in large part from individuals on payrolls.

Right here's where YOUR bond selling responsibilities DOUBLE!

For this extra money must be raised *in addition* to keeping the already established Pay Roll Allotment Plan steadily climbing. At the same time, every individual on Pay Roll Allotment must be urged to dig deep into his pocket to buy *extra* bonds, in order to play his full part in the 3rd War Loan.

Your now *doubled duties* call for these two steps:

1. If you are in charge of your Pay Roll Plan, check up on it at once—or see that whoever is in charge, does so. See that it is hitting on all cylinders—*and keep it climbing!* Sharply increased Pay Roll percentages are the best warranty of sufficient post war purchasing power to keep the nation's plants (*and yours*) busy.

2. In the 3rd War Loan, every individual on the Pay Roll Plan will be asked to put an *extra two weeks salary* into War Bonds—over and above his regular allotment. Appoint yourself as one of the salesmen—and see that this sales force has every opportunity to do a real selling job. The sale of these *extra* bonds cuts the inflationary gap and builds added post-war purchasing power.

Financing this war is a tremendous task—but 130,000,000 Americans are going to see it through 100%! This is their own best *individual* opportunity to share in winning the war. The more frequently and more intelligently this sales story is told, the better the average citizen can be made to understand the wisdom of turning every available loose dollar into the finest and safest investment in the world—United States War Bonds.

★ ★ ★

BACK THE ATTACK With War Bonds!

This space is a contribution to victory today and sound business tomorrow by ELECTRICAL WORLD

THE MODEL 610-E

MEG-O-METER

A NEW

INSULATION TESTER!!

OPERATES ON ANY 110 VOLT 60 CYCLE A.C. LINE

INSTANTLY INDICATES THE EXACT LEAKAGE OF ALL INSULATION FROM ZERO UP TO

200 MEGOHMS

AT A TEST POTENTIAL OF

500 VOLTS D.C.

* NO HAND CRANKING—The 500 VOLT POTENTIAL is made instantly available by simply throwing a front panel toggle switch.
* DIRECT READING—All calibrations printed in large, easy-to-read type enabling exact determination of leakages from 0 to 200 Megohms. In addition, the Megohm scale is also subdivided into BAD (0 to 1 Megohm) DOUBTFUL (1 to 3 Megohms) GOOD 3 to 200 Megohms sections. The BAD Section which indicates the danger point is printed in red.
* The instrument is housed in a heavy-duty Oak portable cabinet.
* Panel is of solid bakelite engraved by the new "cut in" process which eliminates possibility of letters being scratched off.
* Meter movement—a 4½" 0 to 200 Microampere sensitive meter guarantees extremely accurate readings on all ranges.

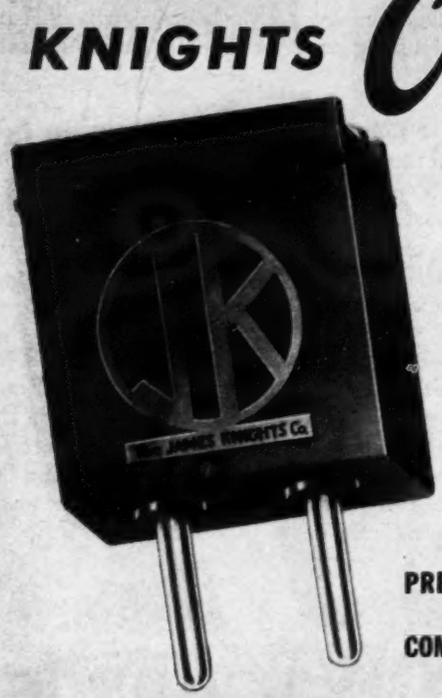
Model 610-E operates on 110 Volt 60 cycle A.C. current. Comes housed in beautiful hand-rubbed oak cabinet, complete with portable cover, test leads and instruction. Size 9½"x8½"x6." Shipping weight 16 pounds. Net Price..... **$52.50**

Model 610-B same specifications as above except battery operated. Price complete.....$62.50

SUPERIOR INSTRUMENTS CO.

DEPT. EW 227 FULTON ST. NEW YORK 7, N. Y.

JAMES KNIGHTS *Crystals*



When the new developments of this emergency period are available, and you re-equip completely with modern communications systems, remember that you cannot buy better crystals than those produced by The James Knights Co. The men of The James Knights Co. are pioneers in the radio crystal field.

PRECISION CUTTERS OF QUARTZ
for
COMMUNICATIONS & OPTICAL USES

The *JAMES KNIGHTS* Co.
SANDWICH, ILLINOIS

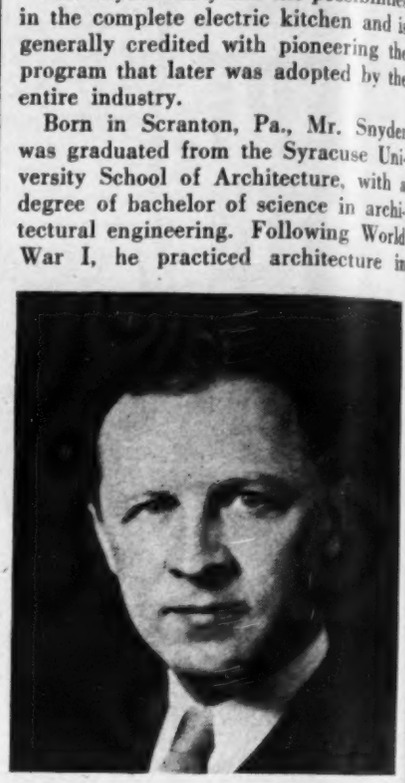
OBITUARY

Carl M. Snyder

Carl M. Snyder, assistant manager of the appliance and merchandise department of the General Electric Co., with headquarters in Bridgeport, Conn., died on August 14 in the New Haven (Conn.) Hospital, after a long illness. He was 48 years of age.

Mr. Snyder early saw the possibilities in the complete electric kitchen and is generally credited with pioneering the program that later was adopted by the entire industry.

Born in Scranton, Pa., Mr. Snyder was graduated from the Syracuse University School of Architecture, with a degree of bachelor of science in architectural engineering. Following World War I, he practiced architecture in



Syracuse, where he designed a wide variety of buildings. In 1926 he became affiliated with the Walker Dishwasher Manufacturing Co., soon being made sales manager and later president of the firm. He remained in that position until 1930, when the General Electric Co. bought out the Walker organization. His activities with G.E. were centered in co-ordinating all electric home appliances in "packages" designed to attract the interest of builder, merchandiser and consumer. He was transferred to New York as president of Houses, Inc., and later as manager of the Home Bureau.

In 1937 Mr. Snyder went to Bridgeport as manager of appliance sales and was appointed assistant manager of the appliance and merchandise department in 1939.

•

▶ WALTER S. GOLL, manager of the Fort Wayne (Ind.) works of the General Electric Co., from 1922 until his retirement in 1938, died on July 31 in that city, after an illness of three weeks. He had been associated with the General Electric Co. during most of 41

…rs spent in active business life. Mr. …ll was a native of St. Louis, Mo., … a graduate of Cornell University.

ALBERT KINGSBURY, founder and pres…nt of the Kingsbury Machine Works, …iladelphia, died in Greenwich, Conn., … July 28, in his eighty-first year. Mr. …ngsbury had been a professor of me…nical engineering and was noted as … inventor of the Kingsbury thrust …ring used in warship and steamship …ving shafts, land and marine turbines. … received a degree in mechanical en…eering from Cornell University in …9 after he had worked in various ma…ine shops. He then became identified …h the teaching staffs of New Hamp…re College and the Worcester Poly…hnic Institute. In 1903 he entered the …ploy of the Westinghouse Electric & …nufacturing Co. at East Pittsburgh, …, remaining there until 1910. The …t few years he spent in perfecting his …ention, and in 1918 he founded the …ngsbury Machine Works. The com…ny was incorporated in 1925 and Mr. …ngsbury was named president. Mr. …ngsbury was a fellow of the American …sociation for the Advancement of …ence and a member of the American …ciety of Mechanical Engineers. He …d many professional honors, includ…g the John Scott Medal of the city of …iladelphia and the Elliott Cresson …dal of the Franklin Institute.

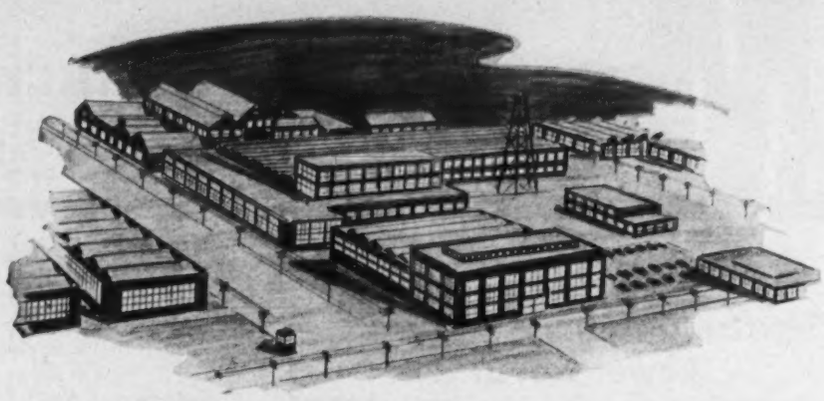
HOWARD F. GORDON, safety engineer …the River Works of General Electric …Lynn, Mass., died in a Boston hospi… on July 25, at the age of 40. He was …graduate of the University of New …mpshire and entered the company's …ployment at Lynn in 1925. In 1929 … was appointed to a post in the per…nnel division's safety group and since …40 had been in charge of all safety …tivities at the River Works.

HARRY FUTORAN, 46, New York re…onal manager for the Airtemp Divi…n, Chrysler Corp., died suddenly, on …ly 9, as the result of a heart attack.

HERBERT W. KEEP, formerly office …nager of the Central Maine Power …, at Rockland, died recently. He was … one time treasurer of the Knox …unty Electric Co., Thomaston, Me., …w a part of the larger system.

WARREN W. FOSTER, formerly chair…n of the executive committee of the …erican Light & Traction Co., and …dge of the Court of General Sessions … New York from 1899 to 1914, died … August 8 in the Norwalk (Conn.) …neral Hospital. He was 84 years of …e. Judge Foster had also been at …e time a director and member of the …ecutive committee of the Cities Serv… Corp. and the Western Light & …action Co.

How to Avoid Using Critical Materials



Use Hemingray Glass Insulators for Inter-Plant Wire Construction Lines

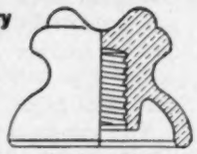
Your inter-company primary and secondary power distribution lines, your fire alarm, communication, watchman's signal, outdoor and protective lighting systems . . . when built on Hemingray glass insulators . . . *do not use* the vast amount of critical material that cable and other types of construction take.

Moreover, no weather is too tough, too quickly varying in temperature, to impair the efficiency of Hemingrays. Reason for it lies in secret Hemingray glass batch-mix—climax of 87 years' experience. Plus Owens-Illinois production-control that results in insulators free of voids, strains and stresses . . . So homogenous that they are unimpaired by sudden temperature changes and impervious to moisture-penetration.

Cost? low to begin with—lower in service life. Hemingrays sold *only* through jobbers.

30 Hemingrays Ready to Solve Your Inter-Plant Problems.

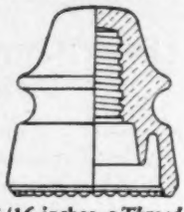
10 Hemingrays for Primary Power Distribution



From this group you can choose Insulators with the following range of characteristics:—

• *Critical Impulse Flashovers* ranging from 75 to 120. • *Leakage Distances* ranging from 4 to 9½ inches. • *Dry Arcing Distances* from 2⅜ to 4⅝ inches. • *Wet Arcing Distances* from 1 to 1¾ inches.

5 Hemingrays for Your Signal Work



From this group you can choose Insulators with the following range of characteristics:—

• *Heights* ranging from 3-13/32 to 4 inches. • *Diameters* ranging from 2¼ to 3¼ inches. • *Groove Diameters* ranging from ⅜ to 11/16 inches. • *Thread Diameters* standard at 1 inch in all 5 numbers.

10 Hemingrays for Secondary Power Distribution

From this group you can choose Insulators, Knobs and Spools with the following range of characteristics:—

• *Heights* ranging from 2-15/16 to 5-1/32 inches. • *Diameters* ranging from 2¼ to 3¼ inches. • *Groove Diameters* ranging from 1 to 2 inches. • *Thread Diameters* at 1 inch in all 10 Numbers.

7 Hemingrays for Telephone and Telegraph

From this group you can choose Insulators with the following range of characteristics:—

• *Heights* ranging from 2-13/16 to 4-9/32 inches. • *Diameters* ranging from 2-7/16 to 3¾ inches. • *Groove Diameters* of either 7/16 or ⅜ inches. • *Thread Diameters* standard at 1 inch in all 7 numbers.

RUSH DELIVERY IF YOU NEED IT!

Complete stock of *all* types of Hemingrays are on hand. You can order as many or as few, as you need. Just 'phone your jobber. He can arrange *immediate* shipment.

USE COUPON FOR CATALOG

OWENS-ILLINOIS Company, Muncie, Indiana
Hemingray Division

Please mail a complete Hemingray Insulator Catalog.

Name_____

Street and Number_____

City_____ State_____

OWENS-ILLINOIS

HEMINGRAY DIVISION • MUNCIE, INDIANA

HEMINGRAY Power, Telephone and Telegraph Insulators

MANUFACTURING-MARKETS

Square D Reports Lower Net in '43

Square D Co. in a report for the six months ended June 30 shows a net profit of $1,155,175 after charges and provision of $125,000 for post-war rehabilitation and $3,773,515 for federal income and excess profits taxes. This is equal, after preferred dividend requirements, to $2.65 a share on 421,360 shares of common stock.

For the first six months of 1942 the company reports a revised net profit of $1,548,178 or $3.57 a common share, when federal taxes of $4,398,382 were provided and $125,000 was set aside for post-war contingencies.

The company states that profits indicated for the 1943 period are subject to renegotiation of Government contracts.

•

Solar Corp. Moves; Dividend Authorized

Solar Manufacturing Corp. and Solar Capacitor Sales Corp. have announced the removal of their general offices from the Bayonne, N. J., plant to 285 Madison Avenue, New York. Manufacturing will continue in Bayonne, West New York, N. J., and Chicago.

Directors of the Solar Manufacturing Corp. have just authorized a special dividend of 15 cents a share on the common stock. The previous payment was a year-end disbursement of 20 cents on December 21, 1942, the first since 1937.

•

New G.E. Air Conditioning Service Center Opened

General Electric Co. has established a new air conditioning service center at 25 Western Avenue, Albany, N. Y., to handle the servicing of G. E. air conditioning and oil heating equipment. Westover-Wolfe, Inc., who formerly had responsibility for both sales and service for these products, will continue as a dealer for them in metropolitan Albany.

G. E.'s new air condition service is under the management of Robert H. Dines, who for the past ten years has been affiliated with Westover-Wolfe. In addition to servicing G. E. air conditioning and heat equipment in greater Albany, the center will be a parts supply depot for 28 air conditioning and heating dealers in upper New York State and western New England.

•

Rome Cable Reports Net for Quarter

Rome Cable Corp. in a report for the quarter ended June 30 shows a net profit of $125,914 after charges and provision of $366,160 for estimated normal and excess profits taxes, equal to 66 cents a share on 189,830 shares of capital stock. This compares with a net profit of $65,898 or 34 cents a share for the quarter ended June 30, 1942, when the federal tax provision amounted to $219,376.

The report states that the interim earnings for 1943 are subject to any necessary year-end and war emergency adjustments, annual audit and possible additional taxes.

•

Bank Loans Increased

Allis-Chalmers Manufacturing Co. has reported to the Securities and Exchange Commission that bank loans outstanding now total $40,000,000, an increase of $5,000,000 over the amount previously reported. Proceeds of the loans are being used for working capital and other corporate purposes.

•

Mico Company Moves

The Mico Instrument Co., Cambridge, Mass., has removed its offices and factory from 10 Arrow Street to 80 Trowbridge Street, in that city. B. W. St. Clair is president. The company manufactures precision apparatus.

Formica Insulation Output Up 50%

Despite acute manpower problems confronting all industry, the Formica Insulation Co., Cincinnati, has increased output approximately 50 percent, although factory personnel has been boosted only 30 percent for the production period ended August 1 compared to the corresponding date in 1942.

D. J. O'Conor, company president, said that the record was attained through "efficiency of factory operation and the fact that new employees, particularly women, have 'broken in' well and have registered remarkable output."

With a backlog of more than six months capacity production, Mr. O'Conor pointed out that "the present output of the Formica company exceeds that of the entire industry in 1929. He added "in the first quarter of 1943, orders exceeded production by about one-third of a month's output and during the second quarter new orders about equaled shipments," reminding that "this condition does not reduce the enormous backlog of more than six months capacity production."

•

New Battery Carbon Plant for Texas

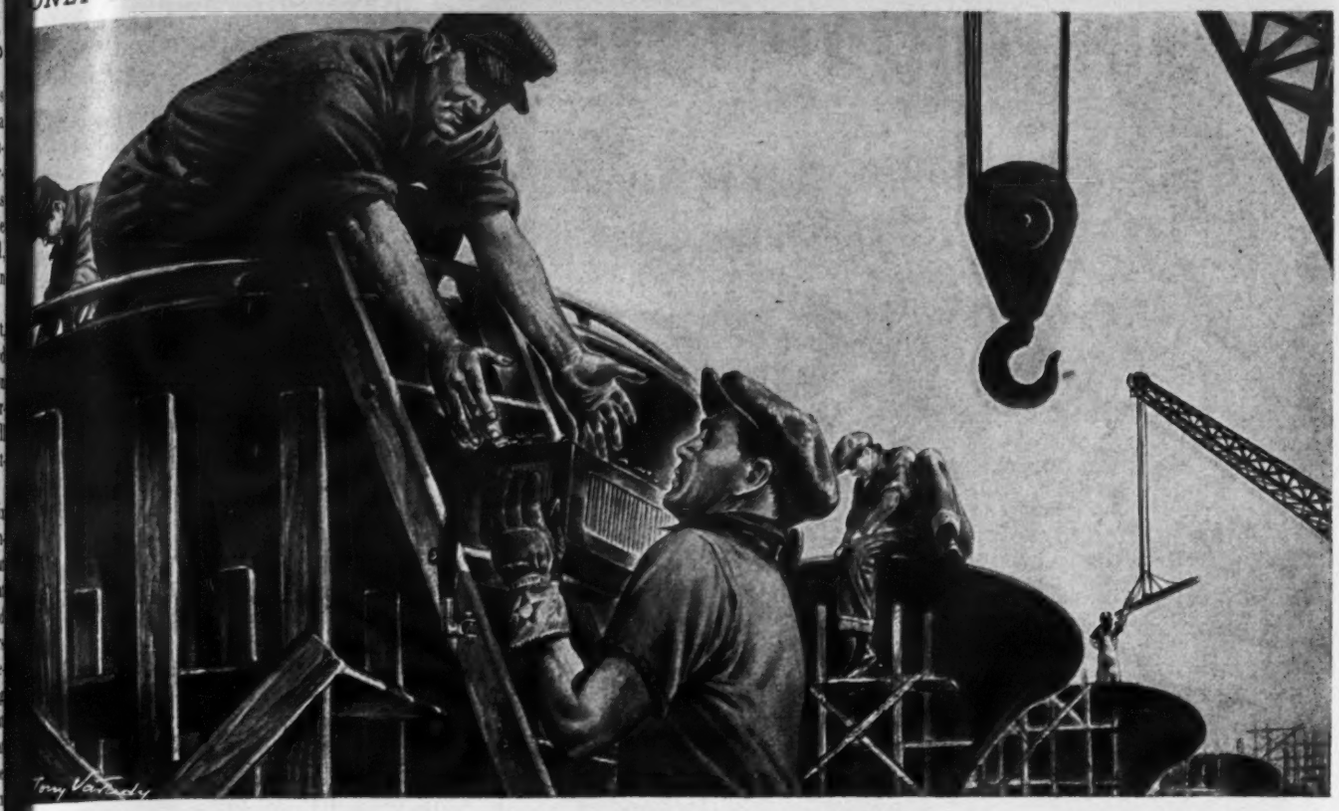
Godfrey L. Cabot, Inc., Boston, Mass., manufacturer of carbon black, has completed a plant at Pampa, Tex., for producing dry cell carbon to help relieve a critical shortage of this material. The carbon was developed by the research department of the Cabot organization in conjunction with dry cell makers throughout the United States and the Fort Monmouth, N. J., laboratory of the U. S. Army Signal Corps. American dry cell makers have previously been dependent on sources of supply in Canada. The Cabot organization has asked the WPB for authority to build a second plant of double the production capacity of the one above named.

•

Hoover Oversubscribed

Public offering of 108,634 common shares of the Hoover Co., maker of vacuum cleaners and other domestic appliances in peacetime, has been substantially oversubscribed. This was the first public participation in this company. There are 416,318 shares of common stock outstanding. The shares recently offered the investing public had been purchased from large holders and do not represent new financing by the company.

ONLY AN ELECTRICAL WHOLESALER COULD THUS SPEED WAR PRODUCTION



Mosquito boats roared out 52 days earlier

Critical Cable, Located By Wesco, Prevented Work-Stoppage—Assured On-Time Delivery

The bad news came when the shipyard had only a few days to complete a Navy contract for small high-speed fighting craft. The manufacturer of flexible jumper cable and lugs for storage batteries essential to the flotilla, advised the shipyard —"Cannot deliver; best possible date 45-60 days." Without these small but vital parts, assembling of batteries would stop and delivery of boats on schedule become impossible.

The Navy Department called in the local Wesco house. By contacting suppliers in several cities, Wesco located a quantity of the material 750 miles away. It reached the shipyards the next afternoon. With battery equipment now complete, the shipyard was able to turn the finished vessels over to the Navy within the contract time.

On hundreds of other occasions Wesco has speeded Victory by performing small procurement prodigies leading to big production results. After the war, this service-ability will be available to business and industry everywhere.

WESCO SPEEDS WAR PRODUCTION

* An important war plant was destroyed by fire on a Friday. During Saturday and Sunday Wesco delivered a complete list of varied electrical supplies that enabled this plant to resume production on Monday morning.
* An air base required overnight delivery of hundreds of electrical items. Five Wesco houses pooled their stocks —made shipment by the following morning.

WESCO SERVES BUSINESS

* By providing trained sales and engineering personnel.
* By buying large quantities at low prices and passing the savings on to small-quantity buyers.
* By warehousing stocks in anticipation of customers' needs.

Westinghouse Electric Supply Co.

150 VARICK STREET • • NEW YORK (13), N. Y.

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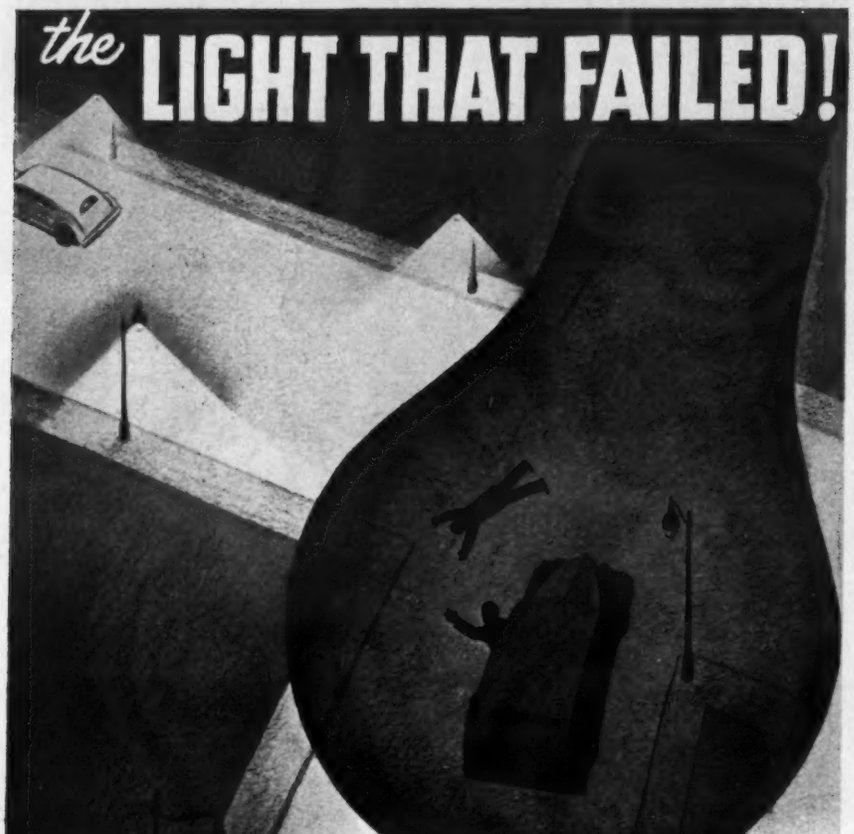


Man hours lost by workers involved in night traffic accidents, *when off the job,* are far greater than any other cause.... The demand for more adequate and better planned lighting is vital. But of equal importance is the need for lamps with greater "staying-power." For the short-lived lights that fail cause isolated blackout spots that result in many traffic fatalities—especially in dimout areas.... Longer life and greater "staying power" are built-in qualities of Slater Lamps. Sturdy, durable, delivering more lumens per square foot at lower cost, they provide maximum lighting efficiency under the severest street lighting conditions. *Catalog on request.*

FOR VICTORY BUY UNITED STATES WAR BONDS AND STAMPS

SLATER ELECTRIC & MFG. CO.
BROOKLYN, NEW YORK
MANUFACTURERS OF STREET LIGHTING LAMPS, AND PRECISION ELECTRONIC TUBES

SLATER

Sylvania Announces New International Divisio

As the first step toward preparatio for increased world-wide operation Sylvania Electric Products, Inc., ha announced the formation of an interna tional division, with Walter A. Coogan as director. As part of its expanded activities, the international divisio will include the operations formerly carried on by the foreign sales depart ment.

To expedite service and delivery t the important war industries of th Southeastern area, Sylvania has estab lished warehouse facilities and divi sional sales offices at Atlanta, Ga. Th new office and warehouse, located at 68 Whitehall Street, S. W., will be under the supervision of Hugh Saussy, man ager of the company's southeastern divi sion.

Sylvania has recently acquired it fifteenth manufacturing plant, a steel and brick structure in Warren, Pa., which, after conversion, will be de voted to the production of assembly parts for radio tube, lighting and electronic products. Production is scheduled for early September.

•

Will Apply Trademark to Electronic Product

North American Philips Co., Inc., with main office and factory at Dobbs Ferry, N. Y., has announced a new trademark, "NORELCO," which will now be applied to products handled by its industrial electronics division at 419 Fourth Avenue, New York.

These products will include elec tronic temperature indicators, direct reading frequency meters, Searchray (industrial and research X-ray) ap paratus, X-ray quartz crystal analysis apparatus and other electronic appli cations.

•

DPC Contract Increased

Nash-Kelvinator Corp.'s contract with the Defense Plant Corporation has been increased $2,650,000. The increase is to take care of additional facilities at a Michigan plant and brings the total contract to a value of $36,000,000.

•

Revises 1942 Earnings

Century Electric Co. has revised its report for 1942 reflecting comple tion of war-contract renegotiations showing a new profit of $415,343 after $776,223 federal taxes, against $460,079 originally reported.

Field Reports on Business

Sales of electrical equipment are being made in small volume, with the outstanding exception of marine and aviation material. New major construction is largely housing, which, on the whole, has a low electrical proportion. Industrial employment, both office and plant, is considerable higher than last year.

PACIFIC COAST

Electrical sales, which surprisingly maintained last year's pace during this spring, are now beginning to lag behind last year, with the exception of marine and aviation material. There will, of course, be no appliance sales to bring up the fall volume despite the fact that department store business in general was never better.

New major construction is largely housing, which has a low electrical proportion. However, the new jobs may be better in this respect because many of them are family units instead of dormitory and are privately financed.

Miscellaneous orders and trends include increasing electrical aviation business in the Bay area; many wiring jobs, often awarded in groups, for scattered food and vegetable dehydration plants; the WPB revival of 19 irrigation projects in 12 western states, with their pumps, motors, and controls and gradual replacement of staple power apparatus, such as stock sizes of distribution transformers, by heavy stuff for yards and bases. Fractional-horsepower and small pump motors are in special demand, recent orders having included 545, costing $22,000, for pressure pumps; a similar order of 1,575, costing $40,000, and 4,000 motors and equipment, costing $45,000, for calculating machines. By contrast, a power company's stock requisition for small distribution transformers covered only 50, costing $7,500.

California industrial employment, both office and plant, is now about 1,110,000, a 40 percent increase over this period of 1942.

CHICAGO

Chicago's electric appliance manufacturers warned the housewife this week not to expect home electric appliances to appear on the market immediately after the war. Time required to get back into production of consumer goods, they said, will depend on the type of product.

Consensus was that home makers will have to wait two months after war's end to get aluminum cooking utensils, about the same length of time for electric ranges, electric water heaters and electric dishwashers; three to four months for the new radios, and up to six months for automatic electric irons, food mixers, toasters, waffle irons and coffee makers.

Chicago's business barometer continues stable at high levels. A year's business changes, reflected in Chicago Association of Commerce indexes comparing June 1943 with June 1942, find cost of building contracts awarded up 2.3 percent; factory payrolls up 34.3 percent; electric power production up 15.4 percent; department store sales up 16.1 percent.

Federal Reserve Bank of Chicago reports a slight upturn in employment and payrolls for both durable and non-durable manufacturing industries in the seventh district during June. Employment index for all manufacturing industries reached 151 during June compared to 149 for April and May and 134 for June 1942. The 1935-39 average equals 100. Payrolls for June were up to 248 from 244 for May, 242 for April and 186 for June a year ago.

NEW YORK

Average monthly employment of workers covered by unemployment insurance laws of New York City is 2,399,523, according to a recent survey by the Commerce and Industry Association of New York. This is 18 percent of the total combined populations of the next ten largest cities in the country. Of the total, 32,490 were listed as electric and gas utility employees.

Nearly $100,000,000 was paid to the government during the first month's operation of the withholding tax, according to a Treasury announcement, but the new tax collection system has failed to affect the continuing high level of retail sales. Department store sales for the week ended August 7 were 6 percent over the corresponding week a year ago, while for the four-week period the gain was 14 percent. However, acceleration in the decline of inventories is expected to result in a slackening of the rate of sales within a comparatively short time.

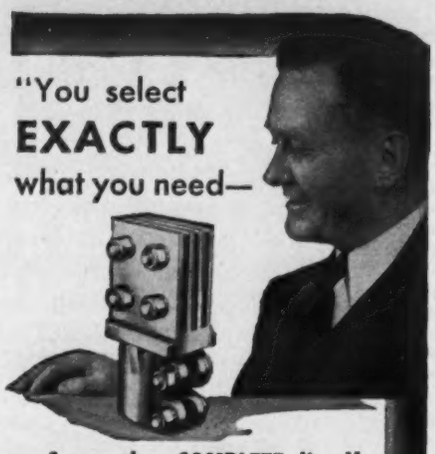
For the week ended August 12 engineering construction awards in the United States totaled $31,773,000, 33 percent lower than the preceding week and 84 percent below the total for the corresponding week in 1942, according to *Engineering News-Record*. The current week's volume brings the 1943 construction total to $2,141,802,000, which, on a weekly average basis, is 66 percent under the total for the 33 weeks of 1942.

NEW ENGLAND

Nearly $2,000,000 has been allocated to New England industries for additional equipment according to an announcement of the WPB last week. Interest is growing in industrial capacitor applications. It is apparent that these will be increasingly used in shipyards employing arc welding units, and fresh bids are likely to be asked for shortly in this field. Orange (Mass.) has voted $12,000 to increase its water supply by the addition of an electric pumping installation. Brookline (Mass.) has prepared preliminary plans for post-war improvements which call for the expenditure of $3,000,000 and include the construction of a new town hall, the modernization of its entire fire department system and the erection of two new fire stations, a project in its completeness that will draw in a considerable amount of special electrical equipment and supplies.

Federal Housing Authority, Washington, D. C., has approved construction of 200 dwelling units for Portland, Me., war workers, to cost $600,000. Eighty units will have two bedrooms each and the remainder three each. The program supersedes a tentative plan to convert existing homes into larger dwellings. Pittsfield Works of G. E. have delivered a 3000-kva mobile substation to the Consolidated Gas, Electric Light & Power Co., Baltimore, Md.

New England manufacturers have submitted bids for a large number of small power distribution panel boards, soldering irons, safety switches, and fire alarm and signal systems destined for naval vessels.



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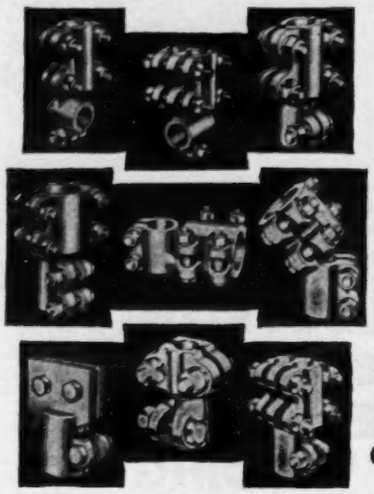

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It isn't only the shipping out of the magazines, but the shipping in of paper, the shipping of engravings and proofs—a delay in any one of which means a delay of the whole product. And when a magazine is not ready another one takes its place on the press, with the result that it must then wait until a press is free. In other words, delays in printing these days are pyramided.

It is terribly embarrassing to have to acknowledge these delays because we have always prided ourselves in "coming out" on time, regardless. We will still do everything possible to try to improve conditions, but in the meantime we ask you to remember that both the railroads and the Post Office have had a tremendous load placed on them and are doing extraordinary jobs. We'll all do our best—please be patient with us.

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General Electric Company, at Detroit

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—welder controls used with series capacitors
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Here is an unusually simple and practical manual, fully explaining the tubes and circuits used to control resistance welders in industrial plants, for the aid of men who work with and maintain these controls. From it, the man with no previous training in electronics can gain a sound knowledge of tubes and circuits and their application in all varieties of control devices, including synchronous timers and stored energy controls. How the tubes work, power requirements, the factors for good welding involved, installation and maintenance of the devices—everything is covered to give the reader the ability to get the most in long life and efficient service from these equipments.

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Sales Opportunities

WEST VIRGINIA—Appalachian Electric Power Co., Charleston, has approved plans for improvements in Cabincreek steam-electric generating station and work is scheduled to be carried out at once.

OHIO—Republic Steel Corp., Republic Building, Cleveland, will carry out expansion in a mill, comprising additional building with mechanical and electrical equipment for increased capacity for government. Cost estimated about $540,000, with financing by Defense Plant Corp.

CALIFORNIA—Navy Department, Washington, D. C., has authorized a new naval training base in Southern California, with amphibious-type airplane facilities, including hangers, shops and other industrial buildings, and miscellaneous structures, aggregating close to 100 in all. Electrical equipment will be installed. Also, power substation with distribution lines, service connections, etc. Entire project will cost over $1,500,000 and will be supervised by Public Works Office, 11th Naval District, San Diego. Work will be carried out at early date.

OHIO—General Motors Corp., General Motors Building, Detroit, Mich., has contracted with government for expansion in certain plants, comprising new buildings, with machinery and electrical equipment. Entire program will cost approximately $4,000,000 and will be financed by Defense Plant Corp. Work is scheduled to begin soon.

LOUISIANA—Louisiana Power & Light Co., New Orleans, plans extensions in transmission lines including overhead crossing over Red River. Application has been made for permission for river span and work will be placed under way as soon as granted.

WASHINGTON—War Department, Washington, D. C., has authorized new military cantonment, consisting of shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also power substation, with electrical distribution lines and service facilities. Project will include barracks, mess halls, administration building and miscellaneous structures and is estimated to cost over $2,000,000. It will be carried out under supervision of U. S. District Engineer Office, Seattle.

INDIANAPOLIS—U. S. District Engineer Office, LaPorte, will change power supply at an ordnance plant from isolated plant to central station service, to include construction of three new power substations, with transformers, switchgear and auxiliary equipment; also certain transmission and distribution line construction. Entire project will cost close to $500,000. Contract for different branches of construction has been let to Todd & Brown, Inc., 9 Rockefeller Plaza, New York, N. Y., general contractor.

PENNSYLVANIA—Publicker Commercial Alcohol Co., 1429 Walnut St., Philadelphia, will carry out expansion in plant for increased production for government, including additional building, with mechanical and electrical equipment. Cost estimated about $750,000, with financing by Defense Plant Corp. Work will proceed at early date.

FLORIDA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has plans under way for several large industrial buildings at a naval base, including machine shop, ship service buildings and auxiliary structures, with mechanical and electrical equipment. Bids are scheduled to be asked at early date. No estimate of cost announced.

TEXAS—War Department, Washington, D. C., has plans maturing for new air force base, comprising hangars, shops, warehouses and other industrial structures, with mechanical and electrical equipment. Also, power substation and distribution lines, with service facilities for barracks, mess halls, administration building and other general structures. Entire project is estimated to cost over $1,000,000, and will be supervised by U. S. District Engineer Office, San Antonio.

MISSOURI—Department of Public Utilities, St. Louis, plans installation of motor-driven pumping machinery, with gross capacity of about 60,000,000 gal. per day, at Howard Bend pumping station, including controls and other electrical facilities. Cost estimated about $350,000. Also, plans new steam power plant at Chain of Rocks pumping station, to cost approximately $75,000, with boilers, pumps and auxiliary equipment. This is part of proposed expansion and improvements in municipal water system, with entire development estimated to cost about $2,825,000. Max H. Coyne is director of department.

NEW YORK—War Department, Washington, D. C., has authorized immediate construction of army air base, comprising hangars, shops, warehouses and other industrial buildings, with mechanical and electrical equipment. Also power substation facilities and electrical distribution lines, with service connections for barracks, mess halls and miscellaneous structures. Entire program will cost over $1,000,000, and will be supervised by U. S. District Engineer Office, Syracuse.

ILLINOIS—Tantalum Defense Corp., 1020 22nd St., North Chicago, manufacturer of metallic specialties for government service, will carry out expansion in plant, including additional buildings and installation of mechanical and electrical equipment. Cost estimated close to $1,100,000, with financing by Defense Plant Corp. Work will be carried out at early date.

SOUTH CAROLINA—Bureau of Yards and Docks, Navy Department, Washington, D. C., has plans for expansion in naval air station, including shops, warehouses and other structures, with mechanical and electrical equipment. Work is scheduled to begin soon. No estimate of cost announced.

OREGON—North Umpqua Timber Co., recently organized subsidiary of Youngs Bay Lumber Co., Warrenton, will begin work soon on large mill on 25-acre tract of land, for production of dimensioned boards for government use in crating for overseas shipments. It will comprise several large one-story units, with mechanical and electrical equipment. Also boiler house and pumping station, transformer station and miscellaneous structures. Cost about $950,000, of which $650,000 will be provided by Defense Plant Corp.

ARKANSAS—Ozark Canning Co., Ozark, plans rebuilding of food-processing and canning plant, recently destroyed by fire, with installation of mechanical and electrical equipment. Loss reported over $100,000.

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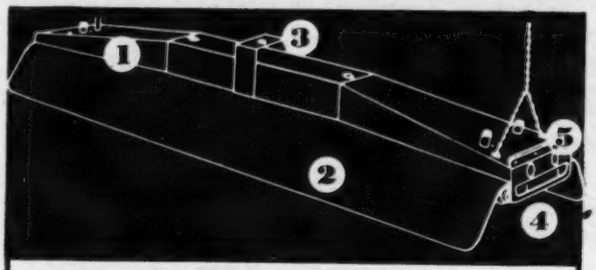

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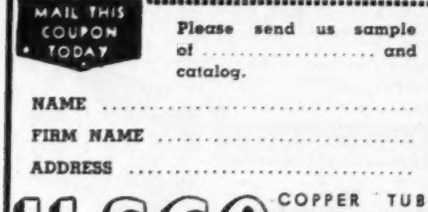

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LETTERS TO THE EDITOR

Wants Early A. I. E. E. Transactions

To the Editor of ELECTRICAL WORLD:

In general, this university's collection of electrical books and periodical literature is a rather good one, but there are lacking some earlier volumes of the *Transactions* of the American Institute of Electrical Engineers. These volumes are very important to one who, like myself, is interested in the history of electrical development. Volumes missing are 1 to 9, inclusive; also Vol. 17.

I suspect that there are among your readers some persons who have these volumes or some of them and, having no further use for them, are about to throw them away. If this be the case, may I suggest that the books be sent to the Library, University of Arizona, Tucson, Ariz., by express collect. The Library will be very grateful for such a donation.

JAMES C. CLARK,
Professor of Electrical Engineering,
University of Arizona.

•

Satisfactory Seasonal Rate

To the Editor of ELECTRICAL WORLD:

In connection with the territory served by the Ellenville Electric Company there is the problem of a large summer population and seasonal business, which condition has existed for a number of years. The normal population is about 5,000, but during the months of June, July, August and September each year there is an influx of vacationists that temporarily increases the inhabitants by 8,000 to 10,000 weekenders and more permanent summer guests.

Our company was faced with the condition of providing equipment and distribution system to meet a decided increase in load and consumption during the seasonal period. Accordingly, it was necessary to create a rate that would, as near as possible, provide for the payment of annual fixed charges and increased operating and maintenance costs during the season when the major proportion of the business was done.

The seaonal rate now in use was established during the year 1934. It pro-

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vides lighting, power and heat service for all purposes for customers whose consumption of energy during June, July, August and September exceeds 50 percent of the total yearly consumption.

The rate is:

First	120 kw.-hr./yr.	$0.10 per kw.-hr.
Next	480 kw.-hr./yr.	0.08 per kw.-hr.
Next..	1,400 kw.-hr./yr.	0.06 per kw.-hr.
Additional energy		0.04 per kw.-hr.

Minimum Charge: $12 per year.

The higher steps in the rate are intended to provide revenues during the seasonal period to equalize as near as possible the increased cost of plant and equipment required to supply this class of business. As a point of information, the amount of kw.-hr. sold under this rate during the four months specified is between 70 and 80 percent of the yearly sales.

The flexibility of the rate allows the customers to reduce their average annual rate if they desire to use service twelve months of the year.

It is probably true that a billing chart cannot be prepared the same as in the case of most monthly rates. However, the matter of computing each bill during the billing routine does not increase to any extent the time and expense as compared with other simplified methods of billing from predetermined rate charts.

After ten years experience with this type of rate it is believed that the results obtained meet very satisfactorily the conditions for which it was developed.

C. D. RAYMOND,
Ellenville Electric Co.,
Ellenville, N. Y.

•

Definition of an E. E.

To the Editor of ELECTRICAL WORLD:

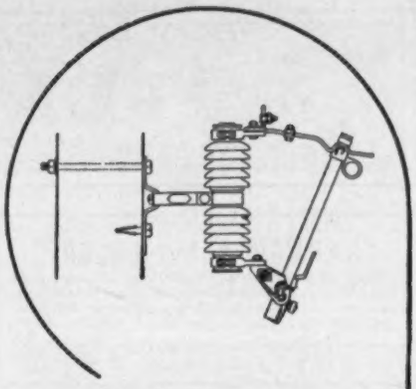
In the July 24 issue of ELECTRICAL WORLD you asked for a definition of an electrical engineer. I might suggest the following: "Any person who, by study and experience or as a technical graduate, is competent to teach others the theory and practice of or who can plan and direct the efficient production, transmission, distribution and use of electrical energy."

F. W. SHACKELFORD,
General Electric Co.,
Philadelphia, Pa.

•

G.E. Opens Mexican Plant

Kenneth K. Boynton, president of General Electric S. A. of Mexico and affiliated companies, has announced completion by the company of a new fluorescent lamp factory in Monterrey.



Fuseholders can be easily and safely removed or replaced with standard ballpoint hotsticks.

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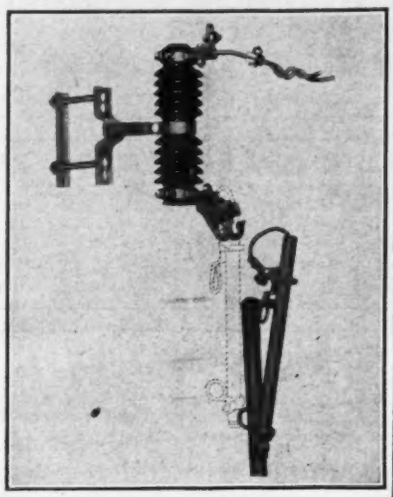

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"Rubbing at the duct mouth can be reduced by installing fairleaders on the cables at this point." — from Electrical World, May 29, 1943 (Cables — How to Make Them Last).

These non-corrosive alloy cable shields clamp in place to take wear at duct mouth. Easily and safely installed without interruption of service. Eliminate expensive repairs. Use STAPUT FAIRLEADERS. *Write for free catalog.*

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BUYERS REFERENCE

330 West 42nd Street, N. Y. City

BOOKS RECEIVED

The Engineer's Manual of English—Revised. By W. O. Sypherd, Alvin M. Fountain and Sharon Brown. Scott, Foresman & Co., New York, N. Y. 503 pages, illustrated. Price $2.50.

Revision of the 1933 edition shows mostly new examples of effective engineering writing taken from current technical literature with much increased emphasis on correspondence and report writing. How to punctuate, spell, paragraph, use clear language, write fluently are all dealt with in detail before discussing the outlining of any written composition. The engineer with aspirations for literary excursions outside his own organization is told how to write for technical journals as well as to frame reports, bulletins and specifications.

Radio Engineers' Handbook. By Frederick Emmons Terman. Published by McGraw-Hill Book Company, New York, N. Y. 1021 pages, illustrated. Price $6.

To a considerable extent this is an electronics handbook as well as one specifically designed for radio engineers. This is because it is replete with basic theory of circuit factors and phenomena, vacuum tubes, amplifiers, modulators, oscillators, power supply. The last third is specifically radio, but the circuit and electronic fundamentals and working data in the first two-thirds make it a convenient and authoritative reference volume for the power engineer who faces an increasing invasion of his low-frequency field by higher frequency apparatus and techniques. The book is well documented for the penetrative user.

Elements of Electrical Circuits and Machinery. By Grover C. Blalock. McGraw-Hill Book Co., Inc., New York. 347 pages, illustrated. Price $3.

A simplified, easy-mathematics condensation of the same author's "Principles of Electrical Engineering" geared to the needs of intermediate schools and one-semester course in technical institutions. Problems and 24 laboratory exercises included.

Alternating-Current Circuits. By R. M. Kerchner and G. F. Corcoran. Published by John Wiley & Sons, Inc., New York, N. Y. 553 pages, illustrated. Price $4.75.

A basic text on vector representation, circuit equivalences, resonance, harmonic analysis, coupling, polyphase systems, reactive and power factor, measurements, bridges, transmission calculations, networks, filters, fault and transient computations.

Pre-Service Course in Shop Practice. By William J. Kennedy. John Wiley & Sons, Inc., New York. 337 pages, illustrated. Price $2.

For electrical men the title is a misnomer because four of the 13 chapters give the rudiments of solder and flux technique, wire splicing, rope splices and care, and rope tackle and rigging. An amazing amount of terse, practical advice has been incorporated; there is usefulness for apprentices in more fields than merely the machine shop.

Allied's Radio Data Handbook. Edited by Lieut. N. M. Cooke, U.S.N. Published by Allied Radio Corporation, 833 W. Jackson Blvd., Chicago, Ill. 48 pages, illustrated. Price 25 cents.

Solely a compilation of symbols, conversion tables, RLC formulas and nomograms, transients, transmission line formulas. Ohm's law, trigonometry tables and transformation, coil winding information, tube interchangeability, radio symbols in most useful form.

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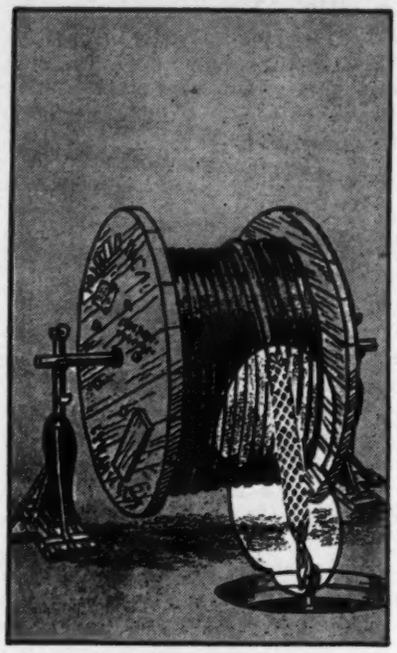

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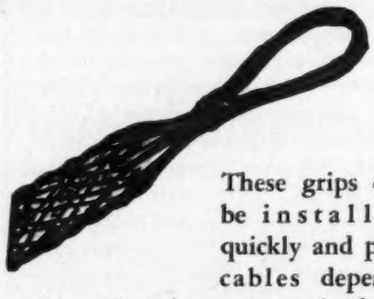
For Pulling in

Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

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Companies to Pay State Sales Tax

Three large South Arkansas corporations have abandoned their efforts to avoid payment of state sales taxes totaling $158,790 on purchases of natural gas and electric power. The Arkansas Supreme Court upheld the right of the state to collect the taxes, but until announcement was made that further legal steps would not be taken, it had been expected higher appeals would be taken. The corporations contended the taxes were not valid because they were on gas and power from pipelines and transmission lines in interstate commerce.

•

Co-Ops Exempted on Unemployment Tax—

Arkansas Supreme Court has ruled that rural electric co-operatives are exempt from unemployment compensation contributions because they were organized under a 1937 act relieving them from such excise taxes.

The decision affirming Jackson Chancery Court held that the Farmers Electric Co-operative Corporation, Newport, was not required to pay contributions on salaries of its employees.

The 1937 law required co-ops to pay a $10 fee for each 100 members, but provided that they "shall be exempt from all other excise taxes of whatsoever kind or nature, except as provided in this act."

•

Energy Requirements Up

Electric energy requirements of the principal public utility systems of the country during June totaled 17,591,048,000 kw.-hr., a gain of 19.1 percent over the same month last year, the Federal Power Commission has reported. Utility estimates of peak demands for December, 1943, are reported to amount to 37,804,252 kw., representing the negligible decrease of about 2,000 kw. under the similar forecast submitted by the utilities in their May report.

•

Gets Army-Navy "E"

Cannon Electric Development Co., Los Angeles, manufacturer of electrical cable connectors for aircraft, sound, radio, power circuits, signal equipment, etc., for use by the Army and Navy, has been awarded the Army-Navy "E" for the excellence of its war production record.

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(Classified Advertising)

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WANTED: Man experienced in steam generation and personnel matters as assistant superintendent of production for large public utility in the Southeast. Must be technical graduate. Experienced, capable man will find opportunity for advancement. Address: P-578, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

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SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. Bixby, Inc., 262 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

ELECTRICAL ENGINEER, 37, married, desires permanent supervisory or executive position. Experience includes various semi-supervisory positions in production, General Electric test course, and ten years in public utility. Has special training in power application and lighting layout. Especially experienced in customer contact and sales. PW-572, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

ELECTRICAL CONSTRUCTION ENGINEER, age 52, 30 years experience installation, test and repair, also line construction. Married, good health, and permanent position only considered. Northwest preferred. PW-577, Electrical World, 68 Post St., San Francisco 4, Cal.

EXPERIENCED UTILITY managing executive open for engagement. New York interview. PW 584, Electrical World, 330 W. 42nd St., New York 18, N. Y.

MANAGER—52 years age, married excellent health; 28 years operating experience with electric, manufactured gas and water utilities with steam hydro, and diesel power. Thorough grounding in subordinate positions and past ten years as manager and president-manager of electric utility located in central-west. Acquainted in central, south central and mountain states. Familiar with and practiced in public relations and corporate procedure as secretary-treasurer and president of utilities. Technical training B. of Sc. in E.E., Supplementary study and experience in mechanical engineering, accounting and law. Employed with present connection thirteen years. Desires change to place requiring more extended use of capabilities in active operating work. PW-585, Electrical World, 520 N. Michigan Ave., Chicago 11, Ill.

WANTED

MECHANICAL DRAFTSMAN

For prominent Michigan food manufacturer. Draft exempt man preferred. Require experience in *general equipment layouts* for construction purposes, *rather than* machine designing. Experience with consulting engineering firm, or engineering department of process manufacturer preferred. Salary dependent upon individual qualifications. Write, giving full statement of personal and professional history, and present salary. Include photograph. Correspondence confidential.

P-582, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

POSITIONS WANTED

OPERATING EXECUTIVE—Age 40, broad utility experience. Successful record achieving practical results by maintaining coordinated organization and harmonious employee relations. Engineering background with well rounded experience in generation, transmission, distribution, sales, rates, accounting, administration, public relations. Interested in general supervisory position as superintendent, manager or executive assistant. Prefer position offering opportunities for improved operations. PW-586, Electrical World, 520 No. Michigan Ave., Chicago 11, Ill.

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2000 Ampere, 6 volt, Hanson-Van Winkle.
1500 Ampere, 6 volt, Hanson-Van Winkle.
750 KW, 250 volts, Allis-Chalmers, synchronous
75 KW, 125 volts, Crocker-Wheeler, synchronous
35 KW, 125 volts, Electric Machinery, squirrel cage

MOTORS—3 PHASE 60 CYCLE

400 HP, 514 RPM, 440 volt, Westg, slip ring.
335 HP, 600 RPM, 2300 volt, GE, syn.
300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
250 HP, 514 RPM, 4000 volt, G.E., syn.
250 HP, 600 RPM, 4000 volt, G.E., sync.
200 HP, 900 RPM, 440 volt, Westg., sl. rg.
200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
200 HP, 450 RPM, 2300/4000 v., G.E., sl. rg.
150 HP, 1800 RPM, 440 volts, General Electric, squirrel cage.
150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
150 HP, 720 RPM, 440 volt, G.E., slip ring.
150 HP, 600 RPM, 440 volt, G.E., slip ring.
150 HP, 400 RPM, 440 volt, G.E., sq. cg.
125 HP, 720 RPM, 440 volt, G.E., slip ring.
100 HP, 900 RPM, 440 Westinghouse, sq. cg.
100 HP, 900 RPM, 440 volt, G.E., slip ring.
100 HP, 720 RPM, 440 volt, G.E., slip ring.
100 HP, 720 RPM, 440 volt, G.E., sq. cg.
100 HP, 600 RPM, 440 volt, G.E., slip ring.
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100 HP, 450 RPM, 440 volt, G.E., sq. cg.
90 HP, 400 RPM, 550 volt, Cr. Whlr, sq. cg.
75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
75 HP, 900 RPM, 220 volt, Fairbanks Morse, slip ring.
75 HP, 900 RPM, 440 volt, GE, sq. cg.
1—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
1—75 HP, 720 RPM, 440 volt, GE, sq. cg.
1—50 HP, 900 RPM, 440 volt, GE, slip ring.
1—50 HP, 900 RPM, 440 volt, GE, sg. cg.

MOTORS—D.C. 230 VOLTS

2—450 HP, 400 RPM, GE
1—250 HP, 760 RPM, Electro Dynamic.
1—150 HP, 750 RPM, Electro Dynamic.
2—150 HP, 400/550 RPM Westinghouse, type SK
1—125 HP, 600 RPM, Westinghouse, SK.
1—100 HP, G.E., 575 RPM.
1—100 HP, 625 RPM, G.E.
1—66 HP, 1000 RPM, G.E., type RC.
1—50 HP, 750 RPM, Westinghouse, type SK.
1—50 HP, 700 RPM, Crocker Wheeler.
1—40 HP, 775 RPM, Westinghouse.

TRANSFORMERS

2—400 KVA, G.E., 4156-240/480 v., Scott taps.
3—300 KVA, Pittsburgh, 7800/440 volts.
2—250 KVA, GE, 6600/2200 volts, 220/440 volts
1—200 KVA, Pittsburgh, 7800-110/220 volts.
3—200 KVA, General Electric, 2200-220/440 volts.
2—150 KVA, G.E., 33,000 2300/4000 Y.
3—100 KVA, Westinghouse, 11,430/250 volts.
1—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
3—100 KVA, Westinghouse, 13200 250 volts.
3—100 KVA, General Electric, 2200-220/110 volts.
3—75 KVA, G.E., 13,500-7500/440 volts.
1—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
1—75 KVA, Pittsburgh, 7800-110/220 volts.
3—50 KVA, Wagner, 4150-220 volts.
2—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
4—37½ KVA, 2200-220/110 v.
7—25 KVA, Westg., air cooled, 440/220-110 v.
1—25 KVA, G.E., 220/110-220/110 volts.
2—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

1—150 HP, 350/1050 RPM, Crocker Wheeler.
2—100 HP, 475/1375 RPM, Electro Dynamic.
1—90 HP, 470/940 RPM, General Electric.
1—35 HP, 500/1500 RPM, Westinghouse.
1—30 HP, 225/900 RPM, Crocker Wheeler.
2—25 HP, 300/900 RPM, Electro Dynamic.
1—20 HP, 750/1500 RPM, General Electric.
1—15 HP, 300/1200 RPM, G.E.
1—13/18 HP, 350/1200 RPM, Electro Dynamic.
2—11½ HP, 500/1500 RPM, Westinghouse, type SK
1—5 HP, 600/1200 RPM, General Electric.
1—5 HP, 450/1800 RPM, Crocker Wheeler.
1—5 HP, 400/1600 RPM, Diehl.
1—5 HP, 225/900 RPM, Electro Dynamic.

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25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

TURBO GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
1—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
1—375 KVA, Westinghouse, non-condensing.
1—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
1—200 KW, G. E., 3 ph., 60 cy., 220 volt, cond.

OIL CIRCUIT BREAKERS

1—3000 amp., 15,000 v., 3 pole, G.E., type FK-130.
1—3000 amp., 600 v., 4 pole, G.E., type FK-24.
1—1600 amp., 7500 v., 4 pole, Westg., B-2.
1—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

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WANTED

-TRANSFORMERS-

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Prices quoted on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI 27, OHIO

Rotary Converters—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 300	G.E.	1200	600	13200
Rotary Converters—3 Ph. 25 Cy.				
2—1500	G.E.	500	225/275	6600
1— 600	G.E.	750	225/275	6600
M.G. Sets—3 Ph. 60 Cy.				
1—1500	G.E.	720	600	6600
1—1000	G.E.	720	250	6600
1— 500	G.E.	720	600	13200

BELYEA COMPANY, INC.
51 Howell Street, Jersey City, N. J.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, etc.

Service backed by 38 years' experience

BREW, WOLTMAN & CO.
30 Church St., New York

This Searchlight Section of **Electrical World**

is an index of reliable sources for Used and Resale Electrical Materials and Equipment now available. Consult the *Searchlight Section* in following issues for later offerings.

If you don't see what you want—ask for it. Ask the advertisers. They are constantly adding to their stocks and may have acquired just what you need. Or, shall we ask them for you?

And, when you have special items to dispose of, use the Searchlight Section of Electrical World to help you locate buyers. . . . Send a list of your equipment and we will gladly give full information as to space and rates. You will be surprised how little it costs to present your offerings to buyers throughout the electrical industry, in this way.

Departmental Staff
ELECTRICAL WORLD, 330 W. 42nd St., New York City

Buying
Good Used Equipment

is frequently the difference between having needed equipment or doing without it.

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■

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES .....
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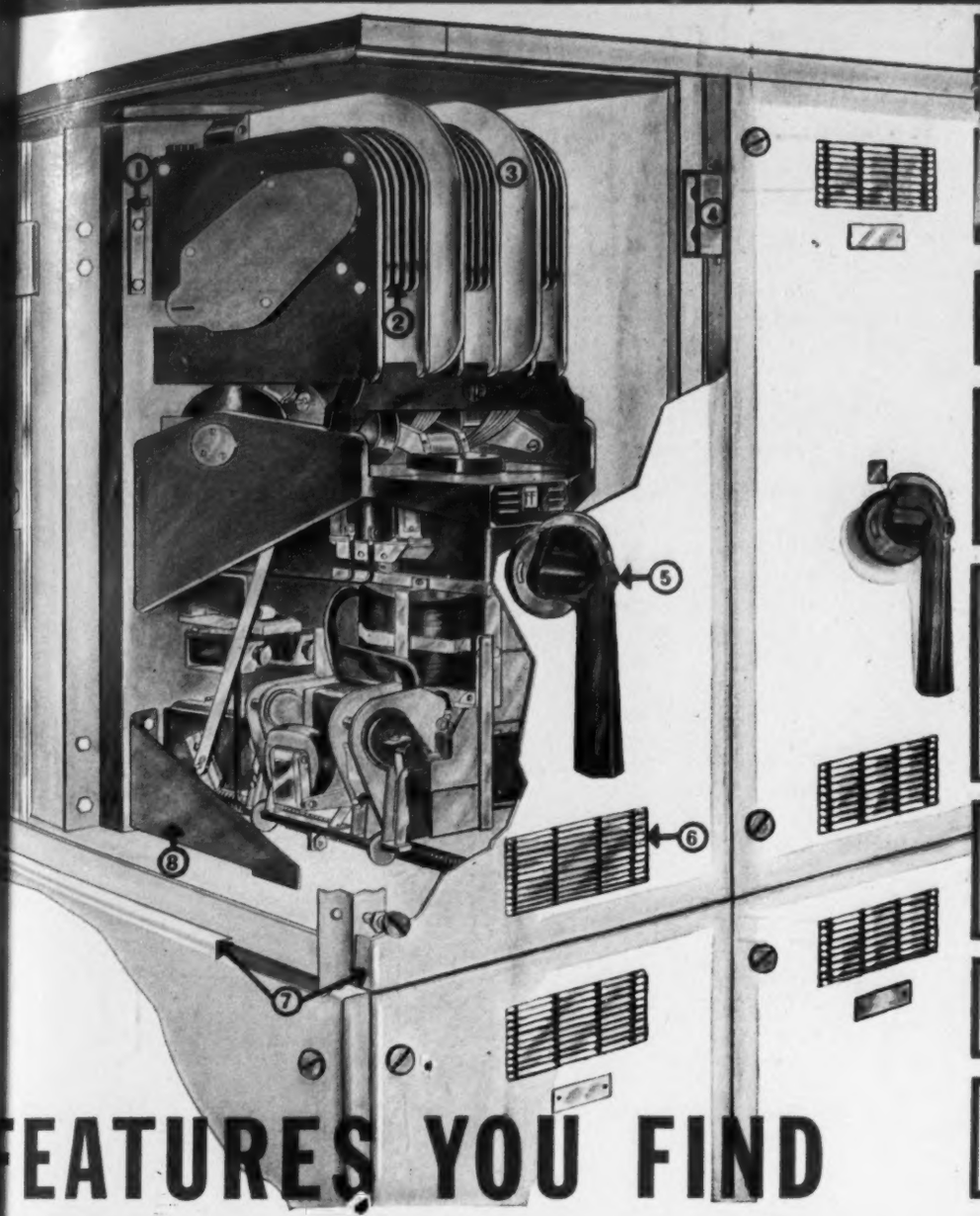
★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**



① **LIFTING HOOK**—for ready removal of the circuit breaker for inspection, using overhead crane or portable hoist.

② **ARC CHUTES**—Magnetic blowout construction provides rapid, safe extinction of arcs from short circuits or heavy overloads.

③ **INSULATING BARRIERS**—provide phase insulation additional to that furnished by arc chutes.

④ **HINGES**—To permit ready drawout of circuit breaker for inspection, hinges allow door to open 100 degrees. They are invisible when door is closed and are slotted to permit individual alignment and adjustment of the door.

⑤ **ROTARY DOOR HANDLE**—attached to hinged door, provides both closing and tripping. Disengages automatically from circuit breaker when door is opened. Thumb-operated locking plate in the top can be raised when handle is in trip position to hold up to three padlocks for protection of workmen against energizing of line before clearance is given.

⑥ **GRILLE-TYPE LOUVERS**—at top and bottom of each door, provide ample air circulation, dissipating heat from series coils. Baffle design helps in keeping out dust.

⑦ **FLANGED DOORS AND PANELS**—make rigid, non-warping members without use of needlessly heavy-gauge sheet.

⑧ **BASE FOOT**—makes the circuit breaker a self-standing unit when removed from compartment and placed on floor or inspection bench.

FEATURES YOU FIND IN I-T-E DRAWOUT SWITCHGEAR

As a method of clearly showing hidden parts, the I-T-E Engineering Department offers this perspective cut-away drawing which has advantages over either photographic or the usual mechanical treatment. We plan a series of these to make the clearest possible explanation of Multumite advantages.

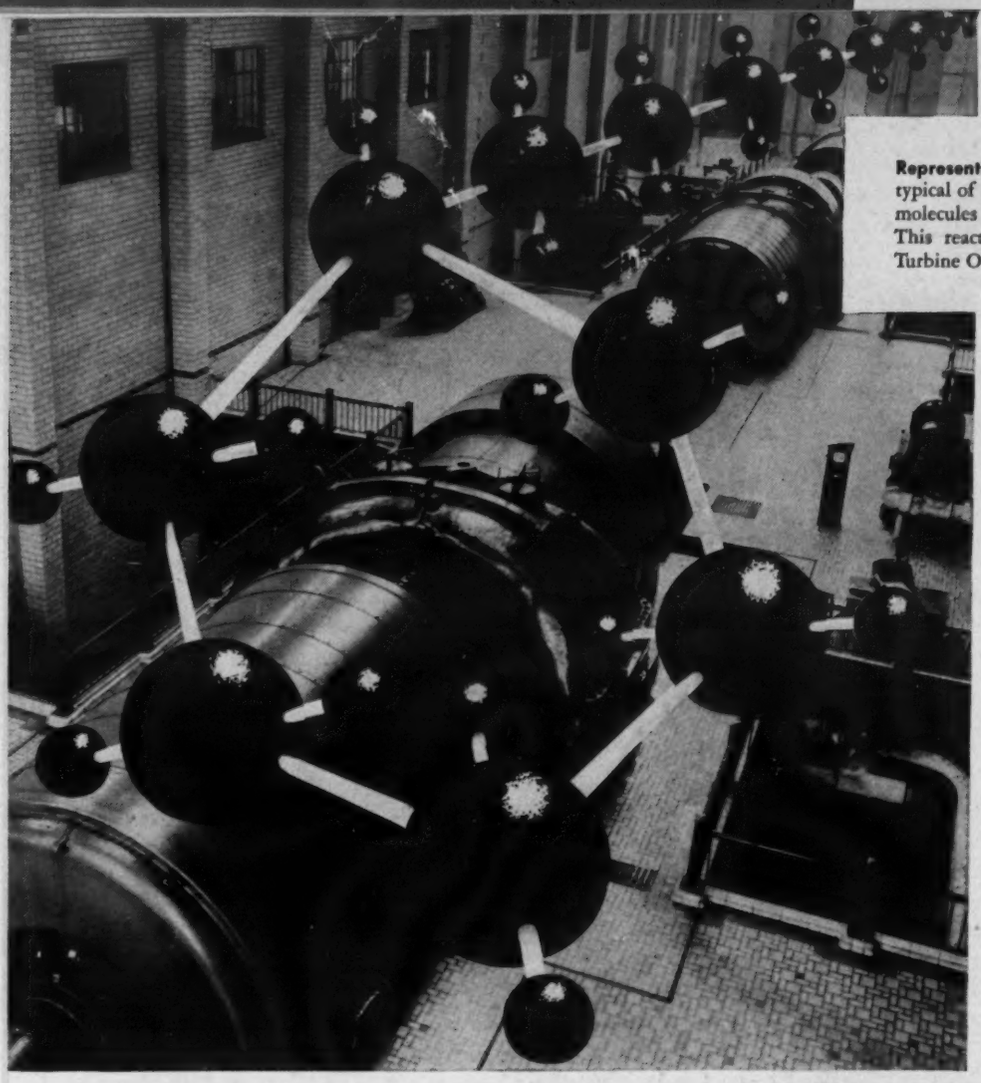
Multumite switchgear assemblies are completely metal-enclosed structures in which I-T-E incorporates many features, including those above, for safety and convenience in control and distribution of electric power.

Write for Bulletin 4207—a thorough description of I-T-E Multumite drawout switchgear.

I-T-E AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

I-T-E CIRCUIT BREAKER CO., PHILADELPHIA, PA.



Representation of an unstable hydrocarbon, typical of some found in turbine oils. Such molecules absorb oxygen and form acids. This reaction is prevented in Nonpareil Turbine Oils by an oxidation inhibitor.

How does a turbine oil oxidation inhibitor operate?

SHORT OF BEING ABLE to look into a turbine oil, and to see molecules and to study their reactions—how an oxidation inhibitor operates must be a molecular theory. The value of such a theory must rest on the record of results secured. In our case, the record consists of the operation of over 650 turbines in which oxidation products have been negligible for as long as sixteen years.

It is our experience that some petroleum molecules have an affinity for oxygen. When they secure it, the products of oxidation are of two types. One type tends to form mostly asphaltene substances, the other to form mostly acids. This we know from cold, chemical analysis.

In refining Nonpareil Turbine Oil, we remove every trace of the asphaltene-formers. Some of these are left in conventional turbine oils because the same process that takes them all out also removes valuable *natural* oxidation inhibitors, which are needed to combat the formation of acids. We can, and do, remove all the asphaltene-formers because we add a patented synthetic inhibitor, which performs the function of the natural ones, and is, in fact, much superior to the natural ones.

Inhibitor at work. Oil molecules oxidize to form acids by what is called an "autocatalytic" or "chain" reaction. At first only a very few molecules of the oil are attacked by oxygen. The first oxidation products promote the oxidation of other oil molecules, and so on until the oil starts to oxidize rapidly. The inhibitor breaks the chain in its earliest stages, thus effectively preventing the formation of acidic oxidation products.

Various other theories might be advanced, but the important factor is the result. This method of checking acidity development is so successful that we guarantee in writing that Nonpareil Turbine Oil's acidity (as expressed by neutralization number) will not exceed 0.15 for the life of your turbine. There are many installations where Nonpareil has been in service from ten to sixteen years without batch treatment, resting, or replacement, and where its neutralization number is still 0.05.

Service records available. With the acidic substances rendered harmless, and the asphaltene-formers removed, troublesome oxidation and sludge deposits are eliminated with Nonpareil. Excellent demulsibility and clean operation are assured. In fact, you'll never need to clean your turbine after you install Nonpareil.

A Standard Lubrication Engineer will gladly answer any questions about Nonpareil and show you service records of plants in your vicinity that are using it. Write or phone the nearest Standard Oil Company (Indiana) office, or 910 So. Michigan Avenue, Chicago 5, Illinois. In Nebraska, write to Standard Oil Company of Nebraska at Omaha 2.

NONPAREIL TURBINE OIL

Oil is ammunition . . . Use it wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING